Surveying Price Stickiness with Large Shocks*

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Abstract

We conduct a survey among German hairdressers about their reasons for adjusting their prices during the Covid-19 pandemic. The most important reason not to increase prices is the fear of losing regular customers, while the most important reasons to increase prices refer to higher costs. We find that firms who report that their customers are more understanding of their prices are more likely to increase prices. Constructing a distribution of relative prices of hairdressers, we also find that the real price rigidity that stems from low understanding is most prevalent in the center of the distribution. We rationalize these findings in the context of a search model, where customers are uncertain about the size of an industry-wide cost shock. Firms with more understanding regular customers are more able to blame higher prices on the cost shock, and can thereby lower their search competition. With heterogeneity in both quality of service and production costs, firms that charge the median price are most likely to be restricted by search competition.

JEL classification: D40, E30

Keywords: survey evidence, real price rigidity, search models, information asymmetry, customer market, learning from prices.

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1 Introduction

What is the reason for the dispersion of prices of homogeneous products? Such price dispersion is a widespread phenomenon (Kaplan and Menzio, 2015), tends to increase with inflation[1], and has negative welfare effects under commonly made assumptions on consumer preferences and production technologies[2]. In this paper, we investigate this question by directly asking the managers of firms in a specific industry — the hairdressing business — about their reasons for setting the price for a specific service — a man's haircut. During the Covid-19 pandemic, German hairdressers were forced to shut down for several months, and had higher production costs due to mandatory hygiene measures. We conduct our survey right after the hairdressers could reopen their business, in March 2021.

Our survey has three main qualitative results: first, hairdressers who do not increase their price do so mainly in order to retain their regular customers. Second, hairdressers who increase their price do so mainly due to increased costs — not due to higher demand, or because their competitors' prices increased. Third, the main explanatory variable for whether a firm increases its price is customer understanding, which is a measure of whether or not customers are understanding of the firm's prices, by the manager's account.

By eliciting the hairdressers' prices, and sampling the hairdressers of various counties all over Germany, we are also able to measure the distribution of prices within and across counties, and each hairdresser's relative position on its county's price distribution. We then compare the results from our survey about the dispersion of prices with micro-level data from the German Consumer Price Index (CPI). We find that the dispersion of the price for a man's haircut within a county is sizable — the standard deviation of the price from the county's median is about 24% — and increases during the course of the pandemic. With our survey data, we can uncover one reason for the high dispersion: we find that firms in the middle of the price distribution increase their price either by less or by more than the average firm — by less, if they report to have low understanding customers, and by more, if they report that their customers are understanding of their prices. We thus find heterogeneous cost pass-through: even conditional on adjusting their prices, firms in the middle of the price distribution split in the size of the price increase by the degree of the understanding that their customers have for their prices.

In order to find an interpretation for the customer understanding-measure, we conducted a follow-up interview with the head of a local hairdresser guild, who also participated in our survey. She told us that it is common for customers to confront their hairdressers in the weeks after a price increase, asking for reasons to justify it. In their explanations, the

[1] Sheremirov (2020) shows that in the period between 2001 to 2011 in the U.S., price dispersion in regular (non-sales) prices is positively correlated with inflation.

[2] If demand falls in the relative price of a product at a decreasing rate, or firms produce at decreasing returns to scale, or both, price dispersion entails welfare losses. Demand that falls in the relative price of homogeneous goods at a decreasing rate arises when consumers substitute the goods from different firms at a constant elasticity (Dixit and Stiglitz, 1977). See Damjanovic and Nolan (2010) for a quantitative assessment of welfare losses from price dispersion.

hairdressers focused on reasons that were evident (e.g. when the news reported increased energy costs) or directly attributable to an individual treatment (e.g. increased wage costs or increased cost of dye), as these were the most effective in convincing their customers. We conclude from this that the customers' understanding of prices should be interpreted as a problem of asymmetric information: upon a price increase, the customers try to figure out if it is justified by an increase in the cost of producing the haircut, and whether that cost increase affects the whole industry or is specific to their hairdresser.

In the second part of the paper, we build a customer search model with firm heterogeneity that rationalizes these findings. In the model, firms only stay in business if they can retain their regular customer — the customer who starts his search at that firm. Searching for (and switching to) another firm entails a cost to the customer. Therefore, his expectation of his outside option — the expected value of consuming at another firm — is an important determinant of whether the firm stays in business. We impose two information asymmetries: only a share of customers — the "high understanding" customers — observe the component of marginal costs that is idiosyncratic to the firm. Additionally, in an uncertainty period, the component of marginal costs that is common to all firms is unobservable for all customers. In such a period, customers try to learn from the firm's price about the common cost component in order to form an expectation of the value of consuming at another firm. High understanding customers are more successful in doing so, as they can disentangle the idiosyncratic and the common cost component. When the common cost increases, firms with low understanding regular customers are therefore more constrained in their price setting, as a higher price is more likely to induce their customers to search for another firm.

In order to fit the model quantitatively to our empirical findings, we postulate that firms are heterogeneous not only in production costs, but also in the quality of their product. Thereby, we take into account that some of the dispersion in the price for a man's haircut that we observe may actually be due to differences in the quality of the service. With a perfectly competitive market, our model yields two prices for the two products that are being traded: low quality haircuts and high quality haircuts, each produced at the lowest possible cost. Relative to that benchmark, the introduction of a search cost that impedes competition actually *lowers* the standard deviation of the price distribution. The reason is that search and switching frictions allow lower productivity firms to enter the market. As monopolists, they charge a higher price than more cost-efficient firms, but a lower price than higher-quality firms. Hence, their existence "bolsters" the middle of the price distribution, and lowers its dispersion.

While differences in product quality may seem like an ad hoc-explanation for price dispersion, it is crucial to make sense of our finding that firms in the middle of the price distribution are most restricted in their price-setting by having low understanding customers. Since firms in that segment of the price distribution are less productive, they also offer a lower surplus to their customers than their competitors. Therefore, for a suitable level of search and switching costs, they can be restricted in their pricing, while more productive

firms have monopoly power. This heterogeneity in restrictedness allows the model to fully account for the differences in the size of relative price increases that we see in our survey. Additionally, we demonstrate that by increasing the share of firms with low understanding customers, the model can also explain a sizable share of the standard deviation in relative price changes by firm over time that we observe for men's haircut prices in the German CPI micro-data. While we build a static model for the purpose of tractability and clarity, we think that adding dynamic strategies would further improve the fit to the pricing data, and allow for a closer comparison to leading models of price dispersion in the literature.

Related literature. Our paper contributes to several distinct strands of the literature that investigates firm pricing and price stickiness. In the empirical part, we build on the idea of Blinder et al. (1998) to ask firms about their pricing decisions. The "classical" approach is the following: firm managers are presented a list of hypotheses. Each expresses an academic theory of price stickiness in layperson's terms. Then, the managers grade how well these hypotheses describe what they are thinking while not adjusting their firms' prices. This approach has spurred a sizable literature that tries to replicate the findings for different countries and types of industries. In appendix A, we provide the hypothesis rankings of Blinder et al. (1998) and 26 replication studies.

The hypotheses that score best overall in that literature pertain to the categories (in that order) of *implicit contracts*, *cost-based pricing*, and *coordination failure*. Implicit contracts can arise between firms and their customers if customers have an incentive to become a "regular" at a firm — due to costs that would arise from switching to another firm. Thus, the firm and the customer enter into a dynamic game: for the customer to be willing to commit to becoming a regular customer, the firm has to implicitly promise not to increase its price unduly. The customer can play a trigger strategy: if she observes a certain pricing behavior that seems excessive, she changes the firm. The literature that presented those theories includes Okun (1981); Rotemberg (2005, 2011); Eyster et al. (2021) (under the headline of "fair pricing") and Nakamura and Steinsson (2011) (who analyze the implications of "internal habits").

Cost-based pricing relates to the simple idea that firms would not increase their price if their costs did not increase. The theory of coordination failure refers to the seminal paper by Ball and Romer (1991). They show that, when adjusting one's price is subject to a menu cost, and one firm's price is a strategic complement to another firm's price, then for "medium"-sized money supply shocks, indeterminancy arises: both no firm adjusting their price, and all firms adjusting their prices, are equilibria.

We deviate in two ways from the "classical" approach of asking about pricing. One prevailing criticism of the method is that the theories that are voted to the top of the rankings usually receive similar and only intermediate scores (Blanchard, 1994). Hence, while the literature has produced consistent evidence for several theories of price stickiness to be most important, the survey approach failed to conclusively select a single best theory. We think that it is unclear, however, whether such a dominant cause of price stickiness

exists across different markets and types of firms. By focusing only on a single industry with relatively homogeneous firms — German hairdressers that are members of local guilds —, we can expect to have a better chance of identifying a single most important reason for price stickiness in this market. Second, we do not ask about hypothetical situtations, but instead query the respondents' actual responses to recent shocks that affected all firms in a uniform way. By that, we eliminate a source of noise in the survey responses of the "classical" approach: respondents may differ in their interpretation of hypothetical situations, and the mental cost of thinking in hypotheticals may introduce a recency bias to their answers.

We find that, indeed, our approach conclusively selects the most important reasons for why firms in our survey do or do not increase prices. The possible downside of our approach is that we have to make the case for external validity: first, the firms in our survey may not even be representative of the hairdresser market, let alone of firms in other industries. Second, the firms' responses to shocks during the Covid-19 pandemic may be special to that particular episode, and may not be indicative of the firms' responses to other shocks of the same type (cost shocks), or even shocks of different types (e.g. a monetary policy shock). We address the first concern by complementing our survey data with micro-level data from the German CPI. We find that there is a clear selection bias in our survey. However, we also find that quantitative results about the divergence of relative price increases over the price distribution are consistent across the two data sources. In general, the use of the CPI micro-level data helps us to put our findings in context.

In response to the second concern about the generalizability of our results to the whole economy, we find it reassuring that two of the three theories that rank highest in the literature — customer markets/implicit contracts, and cost-based pricing — rank highest also in our survey. From the CPI micro-level data, we additionally find evidence that coordination failure may have been an important determinant of price stickiness during the first part of the pandemic, which we do not cover with our survey. In an effort to explain our results in a generalizable way, we then build a model that is not specific to the hairdresser market, and qualitatively and quantitatively matches the main findings from our survey. Our model suggests that our findings are particularly relevant in times of high uncertainty about the consequences of industry or economy-wide shocks.

The model builds on the literature on customer (or consumer) search models. There is an established literature that explains nominal price stickiness in response to a monetary shock in search models (Bénabou, 1988, 1992; Diamond, 1993). Our paper is more closely related to papers that analyze pricing in the presence of search costs and uncertainty about aggregate cost shocks (Bénabou and Gertner, 1993; Fishman, 1996). One can view our model as an extension of Fishman (1996). The main difference is that we postulate a non-Bayesian, "conservative" learning rule that customers follow in order to learn from observed prices about the industry-wide cost level. While we do not microfound the rule, we show that it is "conservative" — namely, customers never overestimate the industry-wide cost level — under one critical assumption. We find it reasonable that customers follow such a

rule under very rare supply-side conditions, like the ones happening during the course of a pandemic, for which they do not have prior beliefs (which makes it a case of "Knightian" uncertainty). Still, the rule allows for ample learning of the industry-wide conditions from observing the firms' prices. Due to the customers' learning, our model predicts that firms with high-understanding customers can optimally increase their prices, which leads to the heterogeneity in cost pass-throughs we observe in our survey data. By introducing this heterogeneity into a search model, we fill a gap in the literature: following the survey evidence by Blinder et al. (1998), the "fair pricing" literature assumes the existence of altruistic firms (Rotemberg, 2011) or behavioral biases of customers (Eyster et al., 2021) in order to explain the importance of customer markets for price stickiness. Instead, we provide a model with profit-maximizing firms and rational customers that can explain the same facts in the presence of information asymmetries.

We also relate to recent work on consumer search models with aggregate uncertainty by Janssen et al. (2017); Janssen and Shelegia (2019). This strand of the search literature usually assumes that customers do not attempt to learn about other firms' prices from the first price they observe — i.e., they hold "passive beliefs" about the other firms' prices (see Anderson and Renault (2018) in Corchón and Marini (2018)). Janssen and Shelegia (2019) show that this assumption is not robust to the possibility that customers "blame" a part of an observed price increase on industry-wide conditions. Our model provides an explanation for why customers would rationally believe that a part of an observed price increase is due to higher industry-wide costs.

A large literature investigates the success of macroeconomic models with time- or state-dependent firm pricing in explaining empirically observed price responses to cost shocks. Karadi and Reiff (2019) document a flexible, but asymmetric price response to changes in value-added tax. They show that a model with menu costs can account for these observations, but failes to generate a strong output response to monetary policy shocks. In section 5, we discuss that our model can explain such an asymmetry without the recourse to menu costs; however, we find it more applicable to cases where the cost shock is less observable to customers, as in the case of industry-specific value-added tax changes (Benzarti et al., 2020). Hobijn et al. (2021) use the Brexit as a quasi-experiment that induces a large common marginal cost shock to firms in the U.K. They find that firms with lower relative prices are more likely to increase their prices in response to the common cost shock, and increase their relative prices by more. They show that neither a model with time-dependent pricing nor a model with menu costs can account for this micro-level observation. Our findings align with those of Hobijn et al. (2021): hairdressers on the lowest end of the relative price distribution increase their relative price by more during the time of the pandemic. Our search model can explain this finding on the intensive margin: since the cheapest firms are relatively productive, they have monopoly power. Consequently, they pass through the cost increase at an optimal rate. The same holds true for the most expensive firms. However, since the latter produce their higher-quality service at higher costs, the share of the cost

increase in their overall production costs is lower. Therefore, the relative price increase declines in the initial relative price position of the firm.

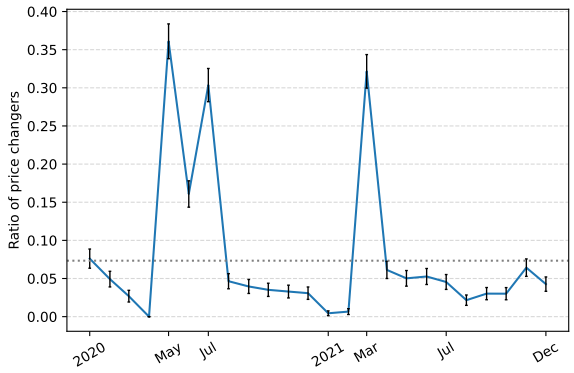
Finally, our paper relates to the literature that collects general observations from micro-data about firm pricing over time, and tries to align the findings with theoretical models on pricing frictions. Nakamura and Steinsson (2008) provide facts about the frequency and size of consumer and producer price increases and decreases in the U.S., and relate them to overall inflation dynamics. Gautier et al. (2022) replicate the analysis for the euro area. Kaplan and Menzio (2015) show that price dispersion of identical goods is a prevailing feature of the data, and find evidence for search frictions as a driving force. Klenow and Willis (2016) establish facts about the behavior of nominal and *relative* price changes (relative to a sectoral price index), conditional on a price change, over time. They document a sizable standard deviation of conditional relative price changes of 14%. They conclude that this evidence implies the need for a theory of *real rigidites*, i.e. frictions that inhibit firms to change their price on the *intensive* margin, not the extensive margin. We show that low customer understanding can be such a real rigidity, and demonstrate in the model that it can explain a large share of the standard deviation in conditional relative price changes in the hairdressing market during the pandemic. The reason is that a large share of low-understanding customers inhibits enough firms in their price-setting so that the price level of the median firm is low. Therefore, the price-increase of firms with monopoly power are higher relative to the median price level. This argument is similar to the one in Mongey (2021), who proposes market power in oligopoly markets as the explanation for large deviations in relative prices.

Our paper is organized as follows. In section 2, we outline the design of our survey and present the main quantitative findings in comparison to those from the German CPI micro-level data. In section 3, we present the first main qualitative result of our survey, which is the ranking of the hypotheses for why firms increase or not increase their prices. In section 4, we present the second main qualitative result of our survey that points towards the important role of information asymmetries, namely, how the customer understanding variable interacts with price stickiness and other firm characteristics. In section 5, we build a customer search model with firm heterogeneity and bring it to the data. In section 6, we conclude.

2 Market Description and Summary Statistics

During the course of the Covid-19 pandemic, the German government imposed two lock-downs during which any hairdressing service was forbidden in Germany. The first lockdown went from March 22 to May 4, 2020. Afterwards, hygiene rules were introduced, such as distancing rules, mandatory masking, and mandatory hair washing before any hairdressing service. The second lockdown, after which we conducted our survey, went from December

(a) Men's haircuts: price change frequency



(b) Men's haircuts: price changes

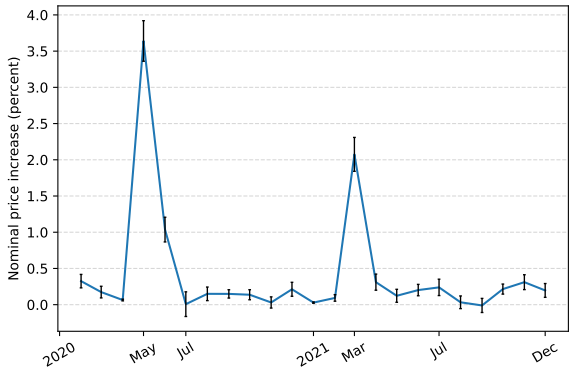


Figure 1: Ratio of hairdressers that changed their price for a man's haircut, monthly, from January 2020 to December 2021 (left panel). Average monthly percent change of the price for a man's haircut, from February 2020 to December 2021 (right panel). The dotted horizontal line shows the average monthly price change frequency for the median firm (left panel). Whiskers depict 68%-confidence intervals of the statistics. Source: German CPI micro-level data, N=442-461.

13, 2020, to February 28, 2021.

We argue that the Covid-19 pandemic and the associated lockdowns have hit all hairdressers with similar shocks: First, the firms have lost months worth of profits, paid bills from their reserves, and some had to borrow money to keep their businesses. Second, the hygiene rules that were imposed after the first lockdown became slightly stricter after the second lockdown: It got prohibited to serve walk-in customers (they needed to book appointments beforehand), the hairdresser had to wear a medical face mask and to replace it after each customer, there had to be a continuous stream of fresh air in the salon, although it was winter, and in some regions with many infections, customers had to be tested negatively. In some states, the hairdresser was allowed to conduct the test. Many of the hygiene rules stayed in place until the end of 2021. Third, the federal value-added tax changed between the two lockdowns: For the second half of 2020, the general VAT rate was reduced from 19% to 16%. Legally, price tags in Germany have to display the price including the VAT. So, firms that have passed on (some of) the tax reduction had changed their pricing lists. In our survey, few firms (14% $\pm$ 2%) reported that they passed on the VAT reduction. In the micro-data to the German CPI, we find that 23% $\pm$ 2% of firms decreased their prices from June 2020 to July 2020. Fourth, many employees in hairdressing received pay rises: January is a common month for discretionary wage increases, and the legal hourly minimum wage for hairdressing increased in several German states on January 1, 2021, by 15 Eurocent, and on July 1, 2021, by 10 Eurocent[3] Fifth, demand for haircuts was likely increased directly after the second lockdown. Several hairdressers auctioned off their first appointments for

[3]In some states, there are binding collective agreements determining the minimum wage in hairdressing. This is the case in Hesse, where the collectively agreed minimum wage increased on January 1, 2021. In some states, there are collective agreements, but employers decide themselves whether to opt in. And in the other states, mostly in Eastern Germany, there are no collective agreements on the minimum wage in hairdressing. The federal minimum wage, which increased on January 1, 2021, and on July 1, 2021, applies. In fact, in these states, many employed hairdressers make the federal minimum wage.

(a) Men's haircuts: price level

(b) Men's haircuts: relative price standard deviation

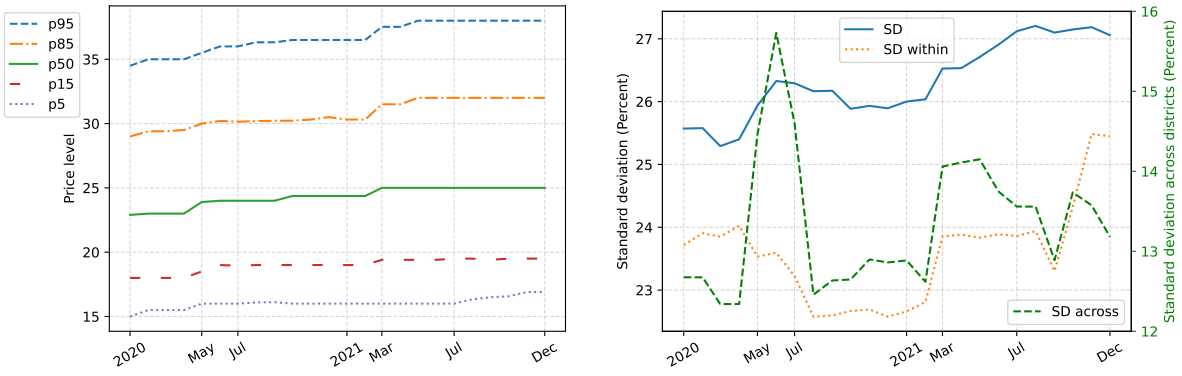


Figure 2: Price for a man's haircut at different percentiles (left panel, N=445-465). Standard deviation of price relative to the median for a man's haircut, over all hairdressers (N=445-465), on average within counties with at least 6 firms (N=121; both left axis), standard deviation across median price of counties with at least 6 firms (N=11-14; right axis) (right panel). Source: German CPI micro-level data.

three-digit prices (and donated them to charity).[4] The average waiting time for appointments in the online booking tool Treatwell was more than two weeks.[5] Notably, the demand later decreased to a constant level below the demand before the lockdown.[6]

We conducted our online survey on the platform *SoSci Survey* from Monday, March 08, 2021, to Friday, April 16, 2021. The questionnaire we used is in Appendix B. It was necessary to possess the URL to participate. We recruited participants in two ways. First, on March 08, 2021, we contacted all local Chambers of Handicrafts (*Handwerkskammern*) because membership is mandatory for German hairdressing firms. However, the response rate was very low. Thus, second, we contacted the heads (*Obermeister*) of all local hairdressing guilds (*Friseur-Innungen*)[7], on March 15, 2021, and asked them to participate and to forward our e-mail to the other members. On April 1, we sent a reminder to the heads of the local hairdressing guilds. After deleting answers with mostly missing or contradictory answers, 281 responses remained. For comparison, in 2020, 77.166 hairdressing firms were registered in Germany (Zentralverband des Deutschen Friseurhandwerks, 2021, p. 12).

2.1 Nominal prices

Our measure for a hairdresser's prices is a standard man's haircut ("short back and sides, wash, cut, blow dry, 25 minutes"). We asked whether the price contained a "hygiene sur-

[4]See `https://www.rnd.de/panorama/friseurin-versteigert-ersten-termin-nach-dem-lockdown-und-spendet-erlos-TJ2JLGGO5E5DA6VHRSZ4YDCS6A.html`, last accessed June 12, 2022.

[5]See `https://www.tophair.de/branche/branche-detailseite/buchungsrekord-zum-re-start`, last accessed June 12, 2022.

[6]See `https://www.br.de/nachrichten/bayern/bayerische-friseure-leiden-weiter-unter-der-pandemie`, last accessed June 12, 2022. The hairdressers in the article conjecture that the hygiene and testing rules are the reason. Other reasons might be the fear of getting infected at the hairdresser's, the diminished importance of having a fresh or professional haircut, and the customers' smaller budgets during the recessionary period.

[7]Guilds are lobby groups with voluntary membership. The local hairdressing guilds are organized on a county-level or slightly larger, and there are 247 of them in Germany in total.

Variable	n	Mean	SD	SD (rel.)	Min	Max
Price before the lockdown (December 2020)	281	25.93	6.22	24%	14	58
Price after the lockdown (March 2021)	281	27.35	6.48	23.7%	14	59
Hygiene surcharge	96	2.38	0.98	41%	0.5	5

Table 1: Summary of the price related variables. The prices and surcharges are in Euros.

charge" and if so, what amount it is. The answers are summarized in Table 1. For a comparison of our results with the overall market for male haircuts in Germany, we turn to micro-data from the German CPI for the years of 2020 and 2021[8]. In figure 2, we show the evolution of the price for a man's haircut over time across different quantiles (left panel), as well as the evolution of the standard devation, relative to the median, overall, as well as within and across counties (right panel). We find that hairdressers in our survey charge on average about 1 Euro more for a man's haircut than the median hairdresser in Germany. Also, the price dispersion in our survey, as measured by the standard deviation, is about 2pp lower than that for all German hairdressers.

Next, we analyze the frequency of price changes in the CPI micro-level data and compare it to our survey results. The microdata allows us to measure the number of days since the last price change for each observed firm and month. We find that the price duration of the median hairdresser in March 2020, on the verge of the Covid-19 pandemic, was 409 days, or 13 and a half months. This is in line with average price durations that are commonly observed for the service sector (Gautier et al., 2022). When interpreting the duration as the average of a geometrically distributed variable, the observed duration translates to a chance of a monthly price change of 7.5%. However, as was shown by Nakamura and Steinsson (2008), the service sector exhibits a strong time interval-dependency, where many prices change after around a year. Therefore, even in normal times, we would expect to see spikes in price changing frequencies at certain points of the year, instead of uniform frequencies.

In the left panel of figure 1, we plot the frequency of changes in the price of a man's haircut during the height of the pandemic. Between 30% and 35% of the hairdressers changed their prices in the months directly after the two lockdowns — in May 2020 and in March 2021 — and in July 2020, where the temporary VAT decrease became effective. Since almost all price changes after the lockdowns are price increases, the plot also shows that in March 2021, a little over 30% of hairdressers increased their prices in Germany. In our survey, instead, two thirds of the sampled firms (64%) have increased their prices. What is more, the average increase of the price for a man's haircut in March 2021 is 2% in Germany, while it is 5.5% for firms in our survey. The differences are also there on the

[8]The dataset allows us to differentiate by male and female haircuts. We only consider male haircuts. Furthermore, we only consider entries that carry the attributes "haircut" (as opposed to shaving) and "wet cut" (washing the hair before cutting became mandatory after the first lockdown, so we delete dry cut-services for all months for consistency). We use the price series "PreisBearbeitet", since it is smoother and has less missing values. We check that the results in this paper are robust to using the series "PreisErhoben" instead. Results are available upon request. For each month, between 445 and 465 observations remain.

intensive margin: the average hairdresser who increased its price in March 2021 increased it by 7.1%, while for firms in our survey, the average conditional price increase is 12.6%. Hence, we find clear evidence that the selection of firms in our survey is biased.

To understand better the incidence of price changes between different dates, we make use of the panel dimension of the microdata. We find that the median firm changes its price once between April 2020 and December 2021, while the average price change in that time frame is 1 and a half times. The duration of the price the hairdresser charged in March 2020 is significantly negatively related to the times it changes its price from then until December 2021: Being on a higher decile on the distribution of price durations reduces the rate of price changes by 6.6pp. Hence, we can interpret the number of days the hairdresser kept the same price as of March 2020 as a measure of her idiosyncratic price stickiness. We then regress the likelihood of changing the price in March 2021 on this measure of idiosyncratic price stickiness, on an indicator variable that equals 1 if the firm reduced its price in July 2020, and on an indicator variable that equals 1 if the firm changed its price between May 2020 and December 2020. We find that the measure of idiosyncratic price stickiness significantly lowers the probability of a price change in March 2021, and that the average firm that passed through the VAT decrease in the summer of 2020 is 30pp more likely to change its price after the second lockdown. On the other hand, controlling for the other variables, the fact that the firm changed its price after the first lockdown does not have a significant effect on whether it changes its price after the second lockdown. This time-independence, together with the result that the median firm changed its price only once from March 2020 to December 2021, allows us to interpret our survey's quantitative results as the average firms' reaction to the cost shock during the whole pandemic. Therefore, we can justifiably match our model in section 5 to the survey data alone, even though the survey only includes price data from December 2020 to March 2021.

2.2 Relative prices

While a man's haircut is a fairly homogeneous product, we cannot interpret the Germany-wide standard deviation of its prices as a measure of price dispersion. The reason is that haircuts are a local good, and that the price levels across different regions in Germany might differ, for example due to differences in customers' incomes. We find that this is indeed the case in the CPI data: The right panel of figure 2 shows that the standard deviation across the medians of counties with at least 6 firms is at around 13% of the average median. To investigate whether the differences across counties are persistent, we regress the log of a county's median price on time-invariant county-fixed effects and the log of the average median over all counties. This simple model, which assumes that the price level of each county is a time-constant share of the average price level, explains 93% of the variation in the data.

Therefore, in order to measure price dispersion of homogeneous products, we compute the

prices of a man's haircut *relative* to the price level in the hairdresser's county. Throughout our analysis, we define a county's price level as its median price. We choose the median instead of the mean in order to be more robust against outliers. The average number of hairdressers that are sampled within a county in the CPI microdata is 9.3, with a minimum of 6 and a maximum of 25 firms. The panel includes 11 to 14 counties where at least 6 hairdressers are sampled, depending on the month. In our survey data, 21 counties include at least 6 hairdressers each. The average number of hairdressers within a county amounts to 9.2 in our survey, with a minimum of 6 and a maximum of 28 firms.

The standard deviation of the price for a man's haircut *within* a county is the standard deviation of the relative prices in that county. The dotted line in the plot in the right panel in figure 2 shows the average of this measure across counties and over time. On average, the standard deviation within counties is at 23.6% of the county's median. This shows that the price dispersion of a fairly homogeneous product — a man's haircut in a county — is large, but still well in the range of the dispersions reported by Kaplan and Menzio (2015). The average standard deviation within counties for the December 2020 prices of our survey participants is significantly lower, at 17.7%.

Comparing the standard deviations across and within counties over time yields an interesting pattern: directly after the first lockdown, the increase in the Germany-wide standard deviation of prices for men's haircuts is driven exclusively by a sharpe increase in price devations *across* medians, while the price dispersion within counties *declines*. Conversely, after the second lockdown, and at the time of our survey, the standard deviation within countries increases by about the same magnitude as the standard devation across counties. This result seems to suggest that after the first lockdown, coordination failure played a significant role in explaining firms' pricing: while in some counties, hairdressers could coordinate to collectively increase their prices, in other counties they failed to do so. The novelty of the pandemic, as well as many distractions that could stem from new government regulations or the concern for one's own health, could have contributed to the failure to coordinate after the first lockdown. The time after the second lockdown, instead, seems to be more suitable for the study of the phenomenon of price dispersion of homogeneous goods.

Having computed the relative prices of firms, we can pool them in one common relative price distribution, that controls for the differing price levels across counties. Thereby, the relative price distribution of a firm becomes a well-defined characteristic. We find that the relative price distribution of a firm at the beginning of 2020 is a significant predictor for the size of their relative price increase during the pandemic: the more expensive the firm, the lower is its relative price increase. In section 5, we show the concrete estimates for various measures (conditional and unconditional on price changes), and explain this finding in the context of our model.

Number of employees	n	Frequency	continuous variable size	indicator variable size
no employees	22	8%	0	0
1 to 3 employees	105	37%	2	0
3 to 6 employees	88	31%	4.5	0
more than 6 employees	66	23%	0	1
Total	281	100%		

Table 2: Size distribution of the participants. When using the size of a firm in regressions, we compromise between continuous variables and indicator variables. We treat the first three options as a continuous variable with the middle value of the bucket, so 0, or 2, or 4.5. The answer "more than 6 employees" is captured by an indicator variable.

2.3 Other firm characteristics

Turning to other characteristics of the firms in our survey, we find that the respondents to our survey are somewhat larger than the average hairdresser. Table 2 summarizes the respondents' answers to our question measuring their firms' sizes by employees. Among hairdressers in Germany, about a third most likely has no employees.[9] Of the other firms (that reported their revenue), around half of the firms has less than 5 employees, around a fifth has between 5 and 9 employees, and around a twentieth has between 10 and 19 employees (Zentralverband des Deutschen Friseurhandwerks, 2021, p. 12).

Regular customers make up the main share of demand for much of the firms in our survey. For the majority of hairdressers in our survey (60%), the share of customers who are regular is at least 80%. For only 5% of the respondents, the share of regular customers is lower than 60%.

3 Ranking of Hypotheses

The goal of the manager survey by Blinder et al. (1998) is to evaluate theories for price stickiness. For comparison to our own results, we report the results of their study in figure 3. In line with the literature that followed up on this study, the hypotheses that pertain to the categories of *coordination failure*, *cost-based pricing* and *customer markets/implicit contracts* receive top scores. In appendix A, we list the results of all replication studies we are

[9]For comparison with the distribution in the general market, we use data from 2018. 53.484 firms (71% of the registered firms) reported their revenues to the authorities (Zentralverband des Deutschen Friseurhandwerks, 2021, p. 12). A firm whose revenue is below the cutoff for exemption to report cannot have a single employee (paid at minimum wage) without making a loss. A firm is exempt from paying VAT if it has had a revenue of less than €17,500 in the previous year and expects a revenue of less than €50,000 in the current year. The federal minimum wage in 2018 was €8.84 per hour. This wage times 40 hours per week times 4.34 weeks per month times 12 months yields more than €18,000, additional to which the employer has to pay social security contributions. It is possible that a firm is exempt from reporting its revenue because it is newly founded and expects a revenue of less than €50,000, so it might have employees without making a loss. There are, however, few entrants to the market. The federal guild reports that 5,867 salons—not firms—were newly registered in 2020, so this number includes existing firms moving or opening branches (Zentralverband des Deutschen Friseurhandwerks, 2021, p. 11).

aware of and provide short descriptions of the theories underlying the hypotheses. Because many theories received similar, intermediate scores and acceptance rates,[10] Blanchard (1994) doubts the fruitfulness of the approach of "asking about prices": The survey approach seems to fail in revealing the single most important theory for price stickiness.

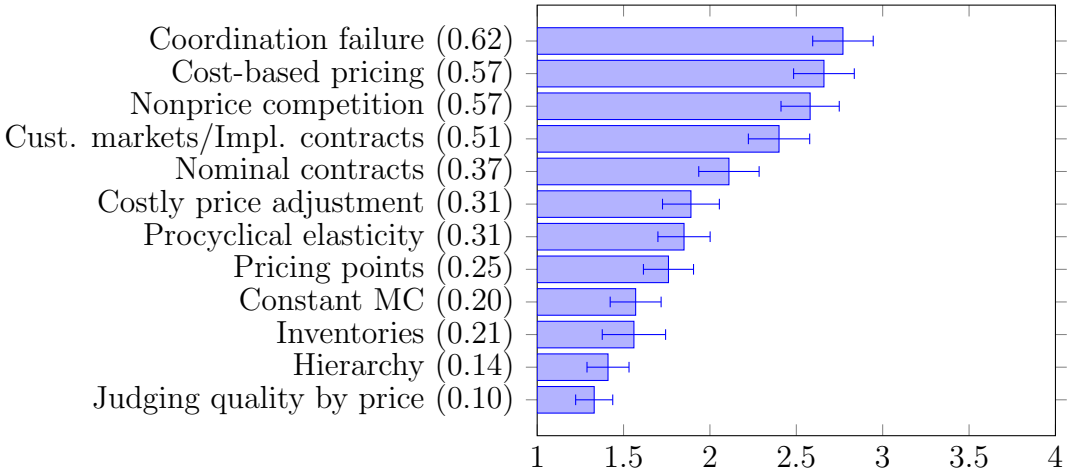


Figure 3: The original survey results by Blinder et al. (1998, p. 110). The grades go from 1 to 4. In the brackets behind the name of the hypothesis is the acceptance rate, which is defined as the share of managers that grade the respective hypothesis 3 or 4. If a firm rejected the premise of the hypothesis (e.g. the manager stated that the firm does not have inventories), Blinder et al. directly assigned the grade 1. On the x-axis is the average score of the hypothesis. The error bands are the 95% confidence intervals.

We design our survey to avoid two reasons for similar scores: The first is averaging within and across markets. As different theories are differently important in different markets, averaging leads to more intermediate scores. The same might be true for averaging within a market over small shops and multinational firms. To make the ranking clearer, we survey a single market which consists of rather homogeneous firms; made even more similar due to our sampling bias favoring guild members. The second is the noise from asking about pricing decisions in hypothetical situations. The availability bias makes the managers overweight things they recently experienced when imagining to be in the hypothetical situation. The projection bias makes them misjudge what they would do if the hypothetical situation became real. To reduce this noise, we ask the hairdressers about their actual behavior in the wake of recent shocks.

The results of our survey for why firms do not increase their price show similar scores in the middle of the ranking, but two clearly winning hypotheses at the top (see Figure 4). The presented hypotheses are based on those in Blinder et al. (1998). We asked about versions of coordination failure (competitors' prices not up), cost-based pricing (cost not up, not passed on VAT reduction), customer markets/implicit contracts (retain regular customers), nominal contracts (prices contracted), costly price adjustments (unsure about increasing, avoid temporary increase), procyclical elasticity (customers' budgets smaller), pricing points, and hierarchy (could not agree on increase). We excluded menu costs (in their

[10]The data are from Table 5.2 in (Blinder et al., 1998, p. 110). It is the finalized version of the table to which Blanchard's critique referred (Table 4.4 in Blinder 1994, p. 124).

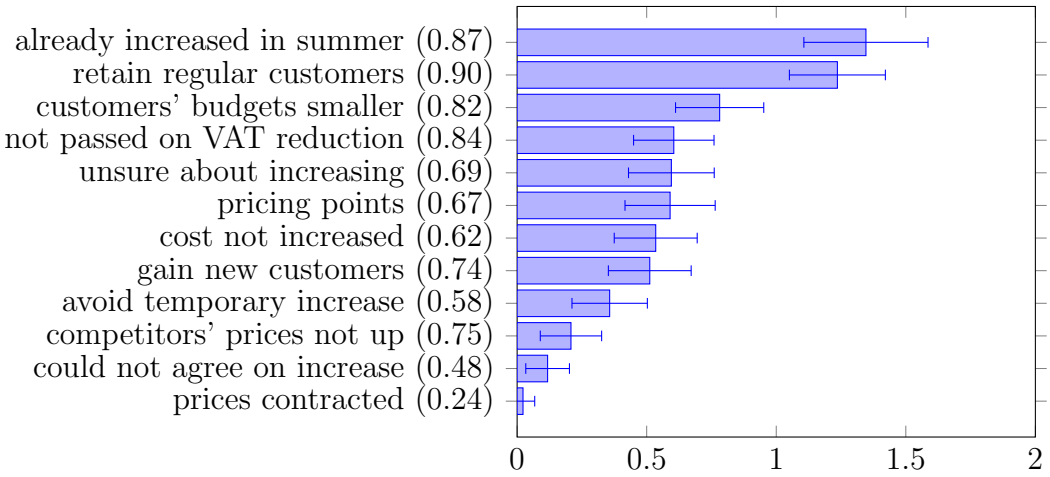


Figure 4: The hypthesis ranking of our survey for reasons not to increase prices. The grading scale has four items: "does not apply," "has played no role" (0), "has played some role" (1), and "has played an important role" (2). Following Blinder et al. (1998), if the respondent marked a hypothesis as not applicable and assigned no grade, we assign the lowest grade, 0. We define the acceptance rate in the bracket as the share of respondents that did not say the hypothesis does not apply, but assigned a score. On the x-axis is the average score with error bars showing the 95% confidence interval.

literal meaning), non-price competition, inventories, constant marginal cost, and judging quality by price for different reasons. Mostly, we expected those theories to not apply or to be rated as unimportant. Because participants asked for it, we added the option "I did not increase the price because I have increased the price already after the first lockdown" a few days after the start of the survey. Therefore, only about half of our survey participants were presented the version of the survey where this was among the options. However, we also provided an open text box for the participants to report other reasons for not increasing their prices. A few participants reported that they already increased prices through that channel.

We find that retaining regular customers is the winning hypothesis for not increasing one's prices among *state-dependent* reasons. Additionally, we find clear evidence for a form of time-dependent pricing: the majority of firms who did not increase their price in March 2021 report that they already increased it directly after the first lockdown. This is at odds with our finding in section 2 that whether hairdressers increased their price in the summer of 2020 does not significantly predict a price change in March 2021.

The results of our survey for why firms increase their price is shown in figure 4. Compared to the reasons not to increase prices, hairdressers agree with more of the presented hypotheses for why they increase their prices, which is reflected in higher average scores. Still, the reason that hairdressers incur higher costs of producing haircuts, reflected in direct hygiene costs and the indirect cost of a lower capacity in their salons due to distancing measures, scores significantly higher than the other hypotheses. Both hypotheses (as well as several others) are consistent with a cost-based pricing theory. Again, the theory of coordination failure (competitor's prices increased) is rejected by the firms in our survey. Interestingly, firms also report that they did not increase their prices due to higher demand.

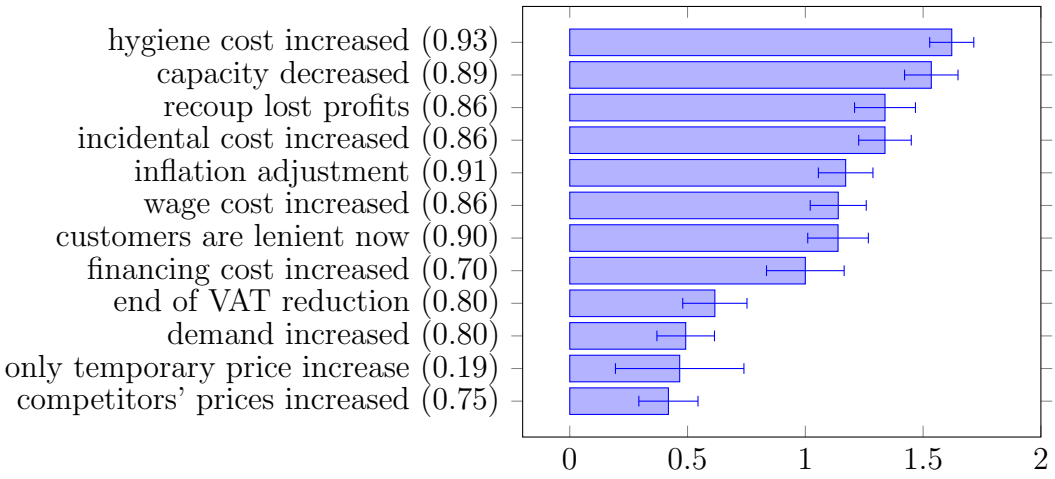


Figure 5: The hypothesis ranking of our survey for reasons to inrease prices. The grading scale has four items: "does not apply," "has played no role" (0), "has played some role" (1), and "has played an important role" (2). Following Blinder et al. (1998), if the respondent marked a hypothesis as not applicable and assigned no grade, we assign the lowest grade, 0. We define the acceptance rate in the bracket as the share of respondents that did not say the hypothesis does not apply, but assigned a score. On the x-axis is the average score with error bars showing the 95% confidence interval.

This finding might suggests that the hairdressers' production capacities are not far from constant returns to scale in the short run. Alternatively, firms with a large share of regular customers might be punished for short-term price increases (see section 5.1.3 for reasons why that might be the case) and therefore rather prefer to increase their capacities in the short run at higher costs.

We conclude that, for the German hairdressing market during the Covid-19 pandemic, our adaptation of the "classical" survey approach identifies clear winning theories for the reasons why firms increase or not increase their prices. We find that two theories that score highly in the literature — customer markets and cost-based pricing — are also the main explanation for price setting in our survey. In contrast, firms in our survey due not report a high role for coordination failure, which is another theory that usually scores well in surveys that ask firms about their pricing. Given our results in section 2, we conjecture that if we had conducted the survey directly after the first lockdown, when the standard deviation across counties spiked, the theory of coordination failure would have scored higher.

4 Customer Understanding: Empirical Results

In this section, we present stylized facts from our survey's data about the role of customer understanding for firm pricing and its correlation with other firm characteristics. As a first step, we construct four variables as composites of the firm-level characteristics that we ask in our survey. The composites are sums of Likert-item scale answers to related questions and measure a common factor among these answers. By inverting some statements, answers from inattentive respondents cancel out, which increases the statistical power of this method. For comparability of the empirical results, we linearly transform the variables so that their

lowest possible level is 0 and their highest possible level is 1.

The first of these variables measures the level of customers' understanding of the firm's prices, as reported by the firm. Table 3 lists the statements and shows with which sign they enter into the sum.

Sign	Statement
+	The customers express understanding for my/our prices.
−	Some customers accuse me of profiteering.
+	The reasons for price increases are understandable for customers.

Table 3: Construction of a variable measuring the understanding of the hairdresser's customers for their prices. The respondents were asked to express their agreement with the statements on a scale from 1 (totally disagree) over 3 (undecided) to 5 (totally agree). We normalize the variable by adding 3 and then dividing the whole sum by 12.

We find that the so formed *customer understanding variable* clusters into two groups: for observations up to the 40%-quantile of this variable, the values range from 0.17 to 0.75, while for observations with values above that, values range from 0.83 to 1. We denote firms with customer understanding above the 40%-quantile as firms with *high understanding customers*, while the other firms have *low understanding customers*.

The second variable measures how satisfied the owners are with their own pricing. Table 4 lists the statements and shows which enter positively and which negatively into the sum.

Sign	Statement
+	I am satisfied with my pricing method.
+	My prices are optimal for the firm.
−	Actually, my prices should be higher.

Table 4: Construction of a variable measuring how satisfied the owners are with their own pricing. The respondents were asked to express their agreement with the statements on a scale from 1 (totally disagree) over 3 (undecided) to 5 (totally agree). We normalize the variable by adding 3 and then dividing the whole sum by 12.

The third variable measures to what extent the owners see the hygiene rule mandating a hair wash before any other procedure as a pricing tool.

Sign	Statement
+	The mandatory hair washing is like a price increase.
+	I profit from the mandatory hair washing.

Table 5: Construction of a variable measuring how the owners view the mandatory hair washing. The respondents were asked to express their agreement with the statements on a scale from 1 (totally disagree) over 3 (undecided) to 5 (totally agree). We normalize the variable by subtracting 2 and then dividing the whole sum by 8.

The mandate could be interpreted as a price increase and, thus, deter owners from an additional price increase. Indeed, the respondents slightly agree that mandatory hair washing is like a price increase, but they slightly disagree to profiting from it. Table 5 summarizes the construction of the variable.

The last variable measures how pessimistic the owners are. Table 6 summarizes the construction of the variable.

Sign	Statement
+	There will be another lockdown this year.
−	We will be back to normal in one year.
+	The hygiene measures will stay for years.
+	Fear of infection will deter customers for a long time.
+	Customers' willingness to pay will lastingly decrease.
−	My personal financial situation will improve.

Table 6: Construction of a variable measuring the owners' expectations and professional uncertainty, expressed as pessimism. The respondents were asked to express their agreement with the statements on a scale from 1 (totally disagree) over 3 (undecided) to 5 (totally agree). We normalize the variable by adding 6 and then dividing the whole sum by 24.

Our data gives rise to seven stylized facts about the relation of customer understanding with a firm's pricing and other characteristics of the firm and its owner. To improve readability, all regression tables and graphs that support these findings are in Appendix C. For each regression, we also estimate a specification that includes a set of control variables. The potential control variables we consider are the firm's size, the share of regular customers, the pricing satisfaction variable, the mandatory hair washing variable, the pessimism variable, and the customer understanding variable. We also estimate a specification where we include the firm's relative price increase between December 2020 and March 2021 as an additional control. By construction of the relative price, including it as a regressor reduces the sample size by a third. Since we sampled firms by hairdresser guild, we state inferences with respect to standard errors clustered at the district-level. All results are robust to not clustering. As another robustness check, we include district fixed effects into the regressions (when possible). We find that the results are robust. In light of the results in section 2 about higher dispersion across districts in times of higher price change-frequency, this is an important clarification: the level of customer understanding affects the relative position of firms *within* districts, rather than the relative position of firms *across* districts. This is crucial for our interpretation of the results within a model where firms compete on the same market (see section 5).

Stylized Fact 1. *Among the non-increasers, the higher the understanding of a firm's customers of its prices, the less important for price stickiness is the motive of retaining its regular customers.*

To support this claim, we run a logit regression where the dependent variable equals 1 if the respondent marked the hypothesis "I did not increase my prices to retain my regular customers" as applicable and 0 otherwise. Only those respondents of our survey who report that they did not increase their price between December 2020 and March 2021 are asked about this hypothesis. Therefore, we can make this statement only for firms that do not increase their nominal price (the "non-increasers"). Since only 10% of the respondents

reported that the hypothesis does not apply, we cannot estimate the full regression specification with all possible controls due to singularity problems (see Table 9). Still, we find the coefficient of the customer understanding variable to be negative and significant at least at the 10%-level in all specifications we consider. We thus conclude that the main reason for price stickiness in the market applies less for firms with high understanding customers.

Stylized Fact 2. *Firms with high understanding customers are more likely to increase their nominal prices.*

To support this claim, we run a logit regression where the dependent variable is an indicator variable for whether the respondent increased their price. Across all considered specifications, the coefficient of the customer understanding variable is positive and significant at the 5%-level (see Table 10). For interpretation of the magnitude of the effect, we run another logit regression where we substitute the customer understanding variable for the high understanding customer indicator variable, and calculate the marginal effects at means (see Table 11). The average firm is 25pp more likely to increase its nominal price from December 2020 to March 2021 if it has high understanding customers.

Stylized Fact 3. *Firms with high understanding customers increase their nominal and relative prices by more.*

We support this claim with a OLS regression where the dependent variable is the firm's nominal price increase in percent between December 2020 and March 2021. Across all considered specifications, the coefficient of the customer understanding variable is positive and significant at least at the 5%-level (see Table 12). The same result obtains if the dependent variable is the firm's relative price increase, which we define as the percent increase of the relative price in December 2020 to that in March 2021 (see table 13). When we substitute the customer understanding variable for the high understanding customer indicator variable, we find that firms with high understanding customers increase their nominal price by about 2.7pp more, and increase their relative price by about 1.9pp more. However, the significance of the results is driven by the extensive margin (i.e., stylized fact 2): repeating the exercise for nominal and relative price increases *conditional* on the firm increasing its price yields positive, but insignificant results. The reason is an interaction of the relative price position of the firm with the effect of the level of understanding of its customers: we find that higher customer understanding has a significantly positive effect on the intensive margin of firm's pricing only for firms that price around the median level of the district (see figure C.1). Together with the fact that the intensive margin of price increases falls in the initial relative price of the firm[11], this interaction confounds the average effect of customer understanding on the intensive margin. In section 5, we explain the differential effect of customer understanding on the intensive margin across the relative price distribution in the context of a search model with firm heterogeneity.

[11]In section 5, we show that the negative relation between the relative price position and the intensive margin is a feature also of the CPI data.

Stylized Fact 4. *Firms with high understanding customers are better able to increase their profit margins.*

We asked the owners how their profit margins after the lockdown compare to their profit margins, first, before the pandemic and, second, before the second lockdown. The possible answers to both questions are smaller (-1), equal (0), or larger (1). We compare the average answers for firms with low understanding and high understanding customers (Table 16). A two-sample t-test shows that firms with high understanding customers were more able to restore their profit margin to levels before the lockdown (at 10%-level), and restore the margins to levels before the pandemic (at 15%-level).

Stylized Fact 5. *Firms with high understanding customers are more satisfied with their own pricing.*

We support this claim with a OLS regression where the dependent variable is the owners' satisfaction with the own pricing (the pricing satisfaction variable). The stylized fact follows from the coefficient of the customer understanding variable being positive and significant at the 1%-level across all specifications that we consider (see Table 17). In terms of magnitudes, the highest value of the customer understanding variable (1) predicts a value of the pricing satisfaction variable around its 75% quantile (.75). Hence, and maybe not surprisingly, owners who report that customers are more understanding of their prices on average also report to be less constrained in their price-setting.

Stylized Fact 6. *Owners of firms with high understanding customers are less pessimistic.*

We support this claim with a OLS regression where the dependent variable is the owners' pessimism variable. Across all specifications that we consider, the coefficient of the customer understanding variable is negative, while it is only significantly different from zero (at the 5% and 10%-level) when we do not control for the relative price (see Table 18). Note that we might simply lack the statistical power to detect a significant relation in the full specification, because the sample size shrinks by one third when adding the relative price as a regressor. One can interpret the result in two ways (which we come back to in section 5): the owners with high understanding customers might be less pessimistic both because they expect to restore their profit margin from before the pandemic faster, and because they are more flexible in their price setting in general.

Stylized Fact 7. *Firms with less employees have more understanding customers.*

To support this claim, we run a logit regression where the dependent variable is the high understanding customer indicator variable. Across all specifications that we consider, the coefficients of the two variables that measure firm size by number of employees — the linear part and the indicator variable for firms with more than six employees — are negative and significantly different from zero (See Table 19). For the average firm, the

magnitude of the effect is sizable: having one more employee reduces the probability of having high understanding customers by 8.8pp, and having more than six employees reduces the probability by 41pp.

If we interpret stylized fact 7 as causal, hairsalons with many employees are more subject to the upward price rigidity described in stylized facts 2 and 3 than smaller firms. Through the lense of the search model we build to explain our empirical findings (see section 5), they are also less able to retain regular customers. Larger firms with many employees may therefore be more dependent on demand from occasional customers (what we call "random demand" in section 5). In fact, we find that larger firms have a lower share of regular customers (see table 21). In turn, firms with a lower share of regular customers (less than 80%) give a higher score to gaining new customers as a reason for not increasing their price (see table 23). For some firms, it may hence be optimal to have a business model that is more taylored towards occasional customers than towards regular customers. This can explain why owners of large firms are *less* likely to report that retaining regular customers is a reason not to increase prices (see Table 9), even though they should be more constrained by the pricing friction that stems from the low understanding of their customers.

Another important prediction of our model is that more productive firms, who can set a higher price relative to their competitors because they offer a higher-quality product, are less subject to the price rigidity that stems from having low understanding customers. If for relatively unproductive, cheaper firms, the risk of having low understanding customers is a constraint on the number of employees they hire, we should observe for relatively more productive, more expensive firms a higher number of employees. Indeed, we observe that the number of employees rises in the relative price in our survey data (see table 24).

We spoke with a hairdresser, who is the head of a local guild. The conversation reflects how the perception of price changes can depend on several factors. We were told that customers confronted their hairdressers in the weeks after a price increase, asking for the reasons for the price increase. The hairdresser, then, had to justify the price increase. In their explanations, the hairdressers focused on reasons that were evident (e.g. when the news reported increased energy costs) or directly attributable to an individual treatment (e.g. increased wage costs or increased cost of dye). On the other hand, the customers would not accept, for example, that the hygiene rule decreased a hairdresser's capacity or that the competitors had increased their prices. As the customers were able to tell, one should not lie. Our conclusion is that building a good relationship takes effort and honesty, and it limits the hairdresser's opportunities for price increases.

5 A customer search model

To rationalize our findings about the importance of customer markets and cost-based pricing for the the hairdressers' pricing during the Covid-19 pandemic, as well as the result on the

differential impact of high customer understanding on real price rigidity over the price distribution, we build a customer search model. We borrow the main idea from Fishman (1996): temporary uncertainty about a general cost increase induces upward price-rigidity for firms whose regular customers perceive a better outside option. We extend their model in two directions: first, we introduce differences across firms in quality of the produced good or service, in addition to differences in production costs of firms. Together with additional assumptions on the customers' demand curve, the heterogeneity in quality allows us to explain the non-monotonic patterns over the relative price distribution that we find empirically. Second, we introduce belief heterogeneity into the search model, similar to Janssen and Shelegia (2019). We assume that customers form rational expectations. Belief heterogeneity stems from different information sets in periods of uncertainty. Customers temporarily face uncertainty about an industry-wide cost shock. Customers that observe the idiosyncratic cost-component of their "regular" firm can perfectly learn the industry-wide cost-component by observing the firm's price in equilibrium. Other customers without access to that information, using a "conservative" learning rule, believe that industry-wide costs have not changed. In order to account for the firm heterogeneity with respect to customer understanding that we find in the data, we impose that the information level is common among all regular customers of one firm. Without loss of generality, then, we consider the simple case that each firm has only one regular customer. We take the shares of the two levels of information among customers in the population as given exogenously, i.e. we do not explain how they are formed.

5.1 Model setup

There are three time periods, $t = 0, 1, 2$. Firms are characterized in three dimensions: costs, quality, and information type of its regular customer. There is a unit mass of firms, indexed by i, of each type.[12] Firm i produces at marginal cost C_{it} in period t that consists of two components: two possible *baseline* marginal cost levels in period t, $\underline{c_t} < \overline{c_t}$, and a time-constant, idiosyncratic cost component, ζ_i. ζ_i is drawn independently for each firm i from a continuous distribution $\mathbb{P}_\zeta$ with mean 0 and bounded support $\left[\underline{\zeta}, \overline{\zeta}\right]$. To start production in period t, firm i has to pay fixed costs F_{it}. For tractability, we choose fixed costs as a function of the other firm characteristics and such that firms without demand from regular customers have no incentive to start production (see section 5.1.2).

The good or service produced by firm i in period t has *quality* $q_{it} \in \{\underline{q_t}, \overline{q_t}\}$, with $\underline{q_t} < \overline{q_t}$. We assume that high baseline costs are necessary but not sufficient to produce a high-quality product or service. As a result, there are three possible baseline cost-quality-

[12] In a non-cooperative, symmetric equilibrium, allowing for a finite number of firms would complicate the analysis mainly in the following way: the search competition of a given firm type would (slightly) differ from that of another firm with the same customer information type, but a different cost-quality pair, as we rule out that a customer returns to the initial firm after searching with non-zero probability (see footnote 15). This would allow for more types of equilibria (see section 5.2.1).

tuples each period: $(\underline{c_t}, \underline{q_t})$, $(\overline{c_t}, \underline{q_t})$, and $(\overline{c_t}, \overline{q_t})$. Kohlhepp (2023) shows that hair salons in Manhattan that are more efficient in organizing their employees across several tasks offer a higher quality-service, and charge a higher price than their competitors. Together with our model, which predicts that high-quality firms charge the highest price for their product (see below), this evidence supports our assumption of heterogeneity in quality of service in the hairdresser business. The *type* of a firm, as characterized by low or high baseline costs, low or high quality of product, and customer information type, stays constant over time. For all firms of one type, the *levels* of cost and quality of product change over time in the same way. Let p_{it} be the price that firm i charges in period t. Quality and costs are measured in the same unit as prices.

Each period and for each firm, a customer j is born that is the "regular customer" of that firm. We denote the "regular firm" of customer j by $i_t(j)$. This means that customer j starts his search in period t at firm $i_t(j)$.[13] Customers are risk-neutral. Each customer j draws firm-specific idiosyncratic preferences ξ^i_{jt}, independently for all firms i, from a uniform distribution over the support $[0, 1]$. A share α of customers is of the *low understanding* type, denoted by $u(j) = 0$, which means that they do not observe the idiosyncratic cost component of its regular firm, $\zeta_{i_t(j)}$. The rest of customers, denoted by $u(j) = 1$, instead observe the idiosyncratic cost component of their regular firm. Observing equilibrium prices, all customers try to back out the new level of industry-wide baseline costs, using a "conservative" learning rule (see section 5.1.3). The model implies that customers who observe the idiosyncratic costs can learn about industry-wide cost changes more easily. Each firm is characterized in part by the information type of its regular customer, $u_{i_t(j)} := u(j)$. All customers are replaced by new regular customers with the same information type at the start of a new period.

5.1.1 The customer's problem

The customer's problem has two stages. In the second stage, customer j has decided that he considers consumption at firm i. First, the customer learns the firm-specific preference ξ^i_{jt}. If i is unequal to the initial firm $i_t(j)$, the customer also learns the firm's price p_{it}. Otherwise, the customer already observed the price of his regular firm in the first stage.[14] Then, he solves the problem whether or not he will buy the good or service:

$$\max_{d_{jt}(i)\in\{0,1\}} d_{jt}(i)(\xi^i_{jt} q_{it} - p_{it}), \tag{1}$$

which has the solution that the customer buys the product, $d_{jt}(i) = 1$, iff $\xi^i_{jt} \geq p_{it}/q_{it}$.

[13] Since our data is on male haircuts, we use masculine pronouns here.

[14] The assumption that firm-specific preferences are only learnt at the second stage simplifies the computations. For this assumption to be sensible, preference shocks must be more difficult to observe than prices. In the present context, one could think of the effort of making appointments with specific employees in a hair salon, who may or may not be available at a certain date. The customer only wants to make this effort once he picked the hair salon. Prices, instead, are more easily accessible on a webpage or the shopwindow.

In the first stage, the customer has the choice between staying at firm $i_t(j)$, whose price he observes, or paying search cost s and searching for a different firm, whose price he has to learn. We make the following set of assumptions about the search process:

Assumption 5.1. *(a) Each customer j searches at most once each period.*

(b) The search is undirected: the allocation of the customer j to a firm after the search will be random.

(c) Customer j cannot deliberately return to his initial firm $i_t(j)$ after searching in that period.

We impose these assumptions for the following reasons. Random search together with firm-specific preferences generates expected demand curves that are price-elastic, even though each customer has unitary demand given his preferences. Price-elastic demand curves are necessary to have equilibrium price dispersion in a search model (Reinganum, 1979). For tractability, we impose that customers search only once, and that they cannot return to the initial firm after the search.[15] We think that this is a reasonable description of regular customers that consider switching their hairdresser: searching for different hair salons and checking up-to-date prices in shopwindows may be physically exhausting and time-consuming. Many hair salons in Germany are small and their webpage may not exist or seem unreliable. Also, we like to interpret s as including a *switching cost*: the relation of hairdressers with their clients can be intimate. Once customers decide to search for different hairdressers, they may incur the psychological cost of "cutting ties" with their old hairdresser. In fact, in our simple framework, one can interpret the cost s as a *pure* switching cost. Instead of assuming that understanding customers are more informed, which has an effect in uncertain times, we could also just assume that they have a higher switching cost. However, such an interpretation does not explain a change in price stickiness in the wake of cost shocks. Such a change is crucial for the model to generate a deviation in relative price changes (see below).

Customers know the time-constant discrete probability distribution $\mathbb{P}$ over the tuples $(c_t, q_t, u) \in \{\underline{c_t}, \overline{c_t}\} \times \{\underline{q_t}, \overline{q_t}\} \times \{0, 1\}$ that characterize all firm types, as well as the distribution of the idiosyncratic cost component $\mathbb{P}_\zeta$.[16] Given his information type $u(j)$, customer j assumes a certain baseline cost $\underline{c_t}^{u(j)}$. Conditional on this belief, he forms rational expectations about the prices of all firms that he does not already observe, $\{p_{it}^{u(j)}\}_{i \neq i_t(j)}$. In order to characterize the search competition of firm $i_t(j)$, it is helpful to calculate the *expected surplus* for customers with information type u of consuming at firm $i \neq i_t(j)$, which we

[15] "Free recall" and a costless return to the original offer generates "return demand", which has interesting implications in an ordered search model, see e.g. Armstrong (2017).

[16] In line with the assumptions outlined above, customers are aware that there are no high quality firms with low costs, so they attribute zero probability mass to tuples $(\underline{c_t}, \overline{q_t}, u)$, $u \in \{0, 1\}$.

compute as

$$V_{it}^{u} := \int_0^1 \max\{\xi q_{it} - p_{it}^u, 0\} d\xi = \int_{p_{it}^u/q_{it}}^1 \xi q_{it} - p_{it}^u d\xi = \frac{1}{2} q_{it} - p_{it}^u - \left(\frac{p_{it}^{u\,2}}{2q_{it}} - \frac{p_{it}^{u\,2}}{q_{it}} \right)$$
$$= \frac{(q_{it} - p_{it}^u)^2}{2q_{it}},\ p_{it}^u < q_{it}. \tag{2}$$

With a slight abuse of notation, we can write $V_{(c,q,u,\zeta)t}^{u(j)}$, since in equilibrium, the expected surplus for customers is the same across all firms i with the same type (c, q, u) and idiosyncratic cost component ζ (see below). Then, customer j searches in the first stage iff

$$V_{i_t(j)t} < \underbrace{\sum_{c \in \{\underline{c_t}^{u(j)}, \overline{c_t}^{u(j)}\}} \sum_{q \in \{\underline{q_t}, \overline{q_t}\}} \sum_{u \in \{0,1\}} \mathbb{P}[(c,q,u)] \int_{\underline{\zeta}}^{\overline{\zeta}} V_{(c,q,u,\zeta)t}^{u(j)} d\mathbb{P}_\zeta(\zeta)}_{=:\mathbb{EV}_t^{u(j)}} - s, \tag{3}$$

where $V_{i_t(j)t}$ is the expected surplus for customer j of staying at his regular firm, which he can compute with the observed price of firm $i_t(j)$. In the following, we call $\mathbb{EV}_t^{u_i} - s$ the *expected outside option* of the regular customer of firm i.

5.1.2 The firm's problem

A firm is characterized by the tuple (c_t, q_t, u, ζ). Given its marginal costs $C_{it} = c_{it} + \zeta_i$ and fixed costs $F_{it} =: F_t(C_{it}, q_{it})$, the quality of its service or good q_{it}, and the information type of its regular customer u_i, firm i chooses its price in order to maximize its expected period profits:

$$\max_{p_{it}} \mathbb{E}_j^u \left[d_{jt}(i) \right] (p_{it} - C_{it}) - F_{it}. \tag{4}$$

The expected demand $\mathbb{E}_j^u \left[d_{jt}(i) \right]$ is a function of the firm's price and its product's quality, as well as of the expected outside option of its regular customer, which depends on his beliefs. These, in turn, can in general be influenced by the firm's pricing. For this subsection, we assume that the firm takes the regular customer's expected outside option *after* having learnt from prices, $\mathbb{EV}_t^{u_i} - s$, as given. We discuss the customer's learning from prices and additional assumptions on firms' pricing decisions in section 5.1.3.

In each period t, there are two possible sources of demand for each firm: the demand of its regular customer, and random demand from customers that search. We denote the mass of random demand from search expected in period t as $\mathcal{D}_t \in [0, 1]$. First, suppose that firm i's regular customer does not search, regardless of firm i's price p_{it}. Then, since the firm-specific preferences ξ_{jt}^i are independent among customers, the total expected demand

of firm i is given by

$$(1+\mathcal{D}_t)\int_0^1 \mathbb{I}_{\xi \geq p_{it}/q_{it}} d\xi = (1+\mathcal{D}_t)\max\left\{\left(1-\frac{p_{it}}{q_{it}}\right),0\right\}. \tag{5}$$

Without competition from other firms, and under the condition $p_{it} \leq q_{it}$, firms set their monopoly price if production is profitable:

$$\begin{aligned} p_{it}^m :=& \arg\max_{p_{it}} (1+\mathcal{D}_t)(1-p_{it}/q_{it})(p_{it}-C_{it}) - F_{it} \\ =& \arg\max_{p_{it}} -\frac{(1+\mathcal{D}_t)}{q_{it}}\left[\left(p_{it}-\frac{C_{it}+q_{it}}{2}\right)^2 - \left(\frac{q_{it}-C_{it}}{2}\right)^2\right] - F_{it} \\ =& \frac{C_{it}+q_{it}}{2} \text{ if } F_{it} \leq \frac{(1+\mathcal{D}_t)}{q_{it}}\left(\frac{q_{it}-C_{it}}{2}\right)^2, \end{aligned} \tag{6}$$

where $p_{it}^m \leq q_{it}$ holds as long as $q_{it} \geq C_{it}$.

The competition that the firm faces is characterized by inequality (3). If the inequality holds in period t, the firm's only expected source of profit stems from random demand. Since by assumption (5.1) customers search not more than once in each period, the firm could set its monopoly price if it decides to not retain its regular customer, generating expected profits

$$\pi_{it}^{\neg r} := \frac{\mathcal{D}_t}{q_{it}}\left(\frac{q_{it}-C_{it}}{2}\right)^2 - F_{it}. \tag{7}$$

For tractability, we assume that the firm's fixed costs $F_{it} = F_t(C_{it}, q_{it})$ are such that $\pi_{it}^{\neg r} = 0$ holds each period. Therefore, if the firm cannot retain its regular customer, it exits the market this period. Together with (6), this level of fixed costs also implies that firms that face no competition remain in business as long as production yields a positive expected surplus, i.e. as long as $q_{it} \geq C_{it}$.

The firm can retain its regular customer by lowering its price p_{it} and thereby offering a higher expected surplus V_{it}. It does so until either its offer is at least as valuable as the customer's expected outside option, $\mathbb{E}\mathbb{V}_t^{u_i} - s$, or the expected profits from retaining the customer fall below zero. Let V_{it}^* denote the expected surplus the firm offers to its customers at the threshold when expected profits are zero. In appendix D.2, we show that

$$V_{it}^* = \left(1+\sqrt{1/(1+\mathcal{D}_t)}\right)^2 \frac{F_{it}}{2\mathcal{D}_t}. \tag{8}$$

Intuitively, the higher the fixed costs are relative to expected random demand, the higher is the expected surplus that the firm is willing to offer its regular customer in order to retain him.

If the regular customer does not search at the firm's monopoly price, it implies that the offered surplus at the monopoly price, defined as V_{it}^m, exceeds his expected outside option.

The firm will never offer a lower expected surplus than V_{it}^m. In sum, firm i exits the market in period t if $q_{it} < C_{it}$ or $\mathbb{EV}_t^{u_i} - s > V_{it}^*$ hold, and otherwise offers the expected surplus

$$V_{it} = \max\{\mathbb{EV}_t^{u_i} - s, V_{it}^m\} \tag{9}$$

while retaining its regular customer. It is easily shown that the optimal price of firm i is in the interval $p_{it} \in [C_{it}, q_{it})$.[17] Then, using the result in (2), it is a function of the optimal expected surplus that firm i offers in period t:

$$p_{it} = p(V_{it}, q_{it}) := q_{it} - \sqrt{V_{it} \cdot 2q_{it}}. \tag{10}$$

5.1.3 Customers' learning from prices

We now describe how customers learn from observed prices about industry-wide costs. In principle, firms can have an incentive to adjust their prices in order to manipulate the customer's belief about the industry-wide cost level, thereby changing the level of competition they are subject to. This could imply a deviation from the above description of optimal firm pricing. The following assumption, together with assumptions we make about the learning behavior of customers, is enough to ensure that this will not be the case in our setting.

Assumption 5.2. *Firms do not charge a higher price than their monopoly price, i.e. for any firm i in any period t, $p_{it} \leq p_{it}^m$.*

This assumption is only binding in periods where customers face uncertainty about the firms' industry-wide baseline marginal cost. As in Fishman (1996), we assume that any uncertainty period t is preceded and succeded by certainty periods. Any customer j with information type $u(j)$ will observe the price $p_{i_t(j)t}$ of his regular firm $i_t(j)$ if it is in business in period t (otherwise, he will directly search for a new firm). The customer enters the period with last period's belief about his outside option, $\mathbb{EV}_{t-1}^{u(j)} - s$, that is shared among customers with his information type, and that is consistent with his knowledge of last period's industry-wide baseline marginal cost level $\underline{c}_{t-1}^{u(j)}$.

If the customer is of the type $u(j) = 1$, he observes the idiosyncratic cost component $\zeta_{i_t(j)}$ of the firm. Together with his knowledge of the last period's industry-wide baseline cost, he can calculate the expected monopoly price of the firm, using (6). If the observed price lies at or below the expected monopoly price, the customer does not attempt to update beliefs. If the observed price lies above the expected monopoly price, the customer concludes that industry-wide baseline costs must have increased, and backs out the new cost level $\tilde{\underline{c}}_{i_t(j)t}^1$ under the assumption that the observed price is the firm's new monopoly price. Also, he updates his expected outside option $\tilde{\mathbb{EV}}_{i_t(j)t}^1 - s$ as implied by the equilibrium that obtains

[17] Let p_{it}^* denote the price that conforms to V_{it}^*. For $\mathcal{D}_t \to 0$, $p_{it}^* \to C_{it}$ by equations (8) and (2). Hence, $C_{it} \leq p_{it}^* \leq p_{it} \leq p_{it}^m < q_{it}$, where the last inequality follows by $C_{it} < q_{it}$, which holds for all firms that stay in the market.

with the new cost level. If the offered expected surplus implied by the observed price $p_{i_t(j)t}$ is at least as large as the updated outside option, and if the price is smaller than the observed quality $q_{i_t(j)t}$, the customer maintains his updated belief (and stays at firm $i_t(j)$): $\underline{c}^1_{i_t(j)t} = \tilde{\underline{c}}^1_{i_t(j)t}$, $\mathbb{EV}^1_{i_t(j)t} - s = \tilde{\mathbb{EV}}^1_{i_t(j)t} - s$. Otherwise, the customer goes back to his old beliefs about the industry-wide baseline cost, $\underline{c}^1_{i_t(j)t} = \underline{c}^1_{t-1}$, and updates his expected outside option accordingly, $\mathbb{EV}^1_{i_t(j)t} - s = \mathbb{EV}^1_t(\underline{c}^1_{t-1}) - s$ (and starts to search).[18]

Proposition 5.1. *Given assumption 5.2 holds, a high understanding customer of firm i learns a fraction γ^1_i of increases in the industry-wide marginal baseline cost in uncertainty period t:*

$$\underline{c}^1_{it} = \underline{c}_{t-1} + \gamma^1_i(\underline{c}_t - \underline{c}_{t-1}),$$

where $\gamma^1_i \in [0,1]$. Any firm i with a high understanding regular customer behaves as described in section 5.1.2, with the customer's expected outside option $\mathbb{EV}^1_{it} - s$ as the one that obtains after he learnt from its price p_{it}.

Proof: Firm i only has an incentive to signal higher industry-wide costs if it is restricted by search competition, in the sense that the expected surplus it offers as monopolist, V^m_{it}, is below its customer's expected outside option as implied by his *non-updated beliefs*, $\mathbb{EV}^1_{t-1} - s$. Let $\underline{c}_t$ denote the true industry-wide marginal baseline cost in period t, which is at least as high as its level in period $t-1$, $\underline{c}_{t-1}$. $\mathbb{EV}_t - s$ denotes the expected outside option that would prevail if the customer knew the industry-wide cost (his true outside option). The customer's initial expected price is $p^{m,e}_{it} = \frac{c_i(\underline{c}^1_{t-1}) + \zeta_i + q_{it}}{2}$. In order to trigger a belief update by the customer, the firm must set a price that is the monopoly price of a firm subject to baseline costs $\tilde{\underline{c}}^1_{it}$ larger than $\underline{c}^1_{t-1}$. On the other hand, by assumption 5.2, the firm never sets a price higher than its monopoly price, so that $\tilde{\underline{c}}^1_{it} \leq \underline{c}_t$.

If the firm is a monopolist under the true outside option of the customer, $V^m_{it} \geq \mathbb{EV}_t - s$, it optimally sets its price to p^m_{it}, which triggers the customer to learn the true industry-wide costs ($\gamma^1_i = 1$). Otherwise, the firm will set a price that signals the largest industry-wide cost $\tilde{\underline{c}}^1_{it}$ such that the implied expected surplus offered by the firm, $V_{it}(\tilde{\underline{c}}^1_{it})$, equals the implied expected outside option, $\tilde{\mathbb{EV}}^1_{it} - s$. The learnt expected outside option is at least as large as $\mathbb{EV}_t - s$, since the expected surpluses that the firm's competitors offer are weakly decreasing in (expected) baseline costs.[19] Since the firm cannot lower the level of

[18] We leave the possibility open that other shocks can happen simultaneously in the uncertainty period, so that the outside option in general differs from period $t-1$ to t even if the customer does not change his belief about the industry-wide baseline costs. For the experiment we consider, however, customers that do not learn about the cost increase will just revert to their last period's expected outside option.

[19] We assume that in each period t, at least one firm type is a monopolist in all possible equilibria, so that the outside option does not become indeterminate. Also, it could be optimal for the firm to offer an expected surplus V_{it} strictly higher than its customer's outside option, if the expected industry value $\mathbb{EV}_t$ was discontinuous in expected baseline costs $\underline{c}_t$. Possible discontinuity points are at the threshold values V^*_{it}, which correspond to threshold idiosyncratic costs $\overline{\zeta}^*_{it}(\underline{c}_t)$ at which firms of a given type exit the market. Since the expected industry value integrates over the continuous distribution of idiosyncratic costs, these discontinuities in $\underline{c}_t$ smoothen out in the aggregate.

its (expected) competition below the one that obtains under perfect information, and since customers do not update their beliefs when the observed price exceeds the observed quality of the product, the conditions for staying in business remain as in section 5.1.2, subject to the updated belief $\mathbb{EV}_{it}^{1} - s$. □

If customer j is of the low understanding type, $u(j) = 0$, he does not observe the idiosyncratic cost component. However, given some belief about the industry-wide baseline costs, $\underline{c}^{e}$, and the knowledge of the idiosyncratic cost distribution, he can calculate the maximum price he expects to be charged by firm $i_t(j)$:

$$p_{i_t(j)t}^{max}(\underline{c}^{e}) := \frac{q_{i_t(j)t} + c_i(\underline{c}^{e}) + \overline{\zeta}}{2}. \tag{11}$$

If the customer observes a price $p_{i_t(j)t}$ at or below $p_{i_t(j)t}^{max}(\underline{c}_{t-1}^{0})$, he does not update his beliefs. If the observed price $p_{i_t(j)t}$ is higher than the level of the maximum expected price, he considers the possibility that industry-wide baseline costs have increased to the level $\tilde{\underline{c}}_{it}^{0}$ such that $p_{i_t(j)t}^{max}(\tilde{\underline{c}}_{it}^{0}) = p_{i_t(j)t}$. He also updates the belief about his outside option that would obtain in equilibrium, $\tilde{\mathbb{EV}}_{it}^{0} - s$. If the offered expected surplus implied by the observed price $p_{i_t(j)t}$ is at least as large as the updated expected outside option, and if the price is smaller than the observed quality $q_{i_t(j)t}$, the customer maintains his updated belief (and stays at firm $i_t(j)$): $\underline{c}_{it}^{0} = \tilde{\underline{c}}_{it}^{0}$, $\mathbb{EV}_{it}^{0} - s = \tilde{\mathbb{EV}}_{it}^{0} - s$; otherwise he only updates his belief about his outside option, $\mathbb{EV}_{it}^{0} - s = \mathbb{EV}_{t}^{0}(\underline{c}_{t-1}^{0}) - s$.

Corollary 5.1. *Given assumption 5.2 holds, a low understanding customer of firm i learns a fraction $\gamma_i^0 \leq \gamma_i^1$ of increases in the industry-wide marginal baseline cost in uncertainty period t:*

$$\underline{c}_{it}^{0} = \underline{c}_{t-1} + \gamma_i^0(\underline{c}_t - \underline{c}_{t-1}),$$

where $\gamma_i^0 \in [0, 1]$. Any firm i with a low understanding regular customer behaves as described in section 5.1.2, with its customer's outside option $\mathbb{EV}_{it}^{0} - s$ as the one that obtains after he learnt from its price p_{it}. If the firm's marginal cost change $C_{it} - C_{it-1}$ is bounded above by $\overline{\zeta} - \zeta_i$, it cannot signal any industry-wide cost increase to its customers ($\gamma_i^0 = 0$).

Proof: Firms with low understanding customers can only signal industry-wide costs that are upper bounded by what firms with high understanding customers can signal: $\tilde{\underline{c}}_{it}^{\,0} \leq \tilde{\underline{c}}_{it}^{\,1}$. Then, the proof of proposition 5.1 goes through, with $\gamma_i^0 \leq \gamma_i^1$. For the last statement, we use that the baseline cost expected by the customers ex-ante, $\underline{c}_{t-1}^{0}$, equals the true baseline cost that obtained in period $t-1$. Therefore, $C_{it} - C_{it-1} \leq \overline{\zeta} - \zeta_i$ implies $C_{it} \leq c_i(\underline{c}_{t-1}^{0}) + \overline{\zeta}$, so that firm i cannot trigger a belief update by its customer with a low understanding type unless it sets a price that exceeds its monopoly price, which is ruled out by assumption 5.2. □

We want to add two remarks to our description of the customers' learning from prices. First, while we set the learning rules ad-hoc, we think that its properties are justifiable: given

assumption 5.2, customers following the rules cannot be fooled by firms into overestimating the industry-wide cost increase, and in that sense act *conservatively*. This might be rational if they want to minimize the risk of sticking with a firm when they should have searched.[20] At the same time, customers are interested in learning: when industry-wide conditions worsen and firms have to exit the market as they cannot credibly blame aggregate shocks, customers pay unnecessary search (and switching) costs.

In consumer search markets with uncertainty, demand can increase in the posted price, which was analyzed by Janssen et al. (2017). Assumption 5.2 rules out "extreme" instances of this phenomenon, and is crucial to obtain the above result. To justify the assumption, we make recourse to typical properties of dynamic pricing that we abstract from in our model: in the presence of nominal pricing frictions, firms set the price near their long run price target at the cost of forfeiting higher profits in the short run. The only reason why a firm would increase its price above its monopoly price is to signal higher than realized industry-wide costs to its regular customer, which is only effective in an uncertainty period. When the change in industry-wide costs is expected to be more persistent than the customers' uncertainty about it, the firm's long run price target therefore is upper bound by its monopoly price in the uncertainty period.[21] What is more, our setting with long-lived regular customers lends itself to a micro-foundation for nominal price stickiness: customers could follow a *dynamic* learning rule, where they punish temporary price increases during uncertainty periods by subsequently leaving the firm. Knowing this threat, firms abstain from signaling industry-wide costs that are too high. In turn, customers are willing to learn from the firm's prices. This argument is close to the results in Nakamura and Steinsson (2011): nominal price rigidities can be a *commitment device* that helps firms to achieve more favourable equilibria in customer markets with information asymmetry.

As a second remark, we only consider cost *increases* when describing the learning rules, since this is the relevant case for explaining our survey evidence. However, our analysis also uncovers an asymmetry between cost increases and decreases that may be of interest on its own. At a first glance, learning about industry-wide cost *decreases* might appear to be an easier problem: firms have no incentive to signal *lower* than realized cost decreases, as this would only increase their customer's expected outside option. Hence, high understanding customers could attempt to learn about cost decreases using a symmetric version of the rule described above, but without the need for an analogue to assumption 5.2. However, some firms may have an incentive to exploit the *sluggishness* of the resulting learning rule, which stems from the assumption of adaptive expectations. Suppose that industry-wide

[20] We think this is a reasonable assumption when the change in industry-wide costs is the result of a rare event, like a pandemic, where customers cannot draw on prior knowledge about probabilities of cost shocks. A "conservative" estimation strategy to deal with such Knightian uncertainty can be micro-founded using robust control theory (Hansen and Sargent, 2022).

[21] More than 80% of the respondents to our survey (N=257) in the spring of 2021 agree with the prediction that mandatory hygiene measures to prevent the spread of the virus will remain in place for years to come. Less than 3% of the respondents disagree.

costs decrease in an uncertainty period, and consider a firm whose offered expected surplus at its monopoly price before the cost decrease was exactly equal to its customer's outside option then. If the firm does not change its price, even though its monopoly price now is lower, it does not trigger a belief update by its regular customer. The firm prefers this strategy if the *expected marginal increase* in the customer's expected outside option from signaling lower industry-wide costs outpaces the expected marginal gain to the customer from the firm's price decrease. This is most likely to be the case for firms who offer a lower surplus than their competitors.[22] Different from the case of cost increases, the neglect to pass through lower costs is not easily detectable via patterns in nominal prices: firms may just fix their nominal price until the uncertainty subsides. This scheme is thus also uninhibited by nominal price rigidities.[23]

Our theory thus predicts that industry-wide cost decreases are more difficult to learn from prices than cost increases, especially for regular customers of less profitable firms. This may be a possible explanation for the evidence of asymmetric incidence of tax changes: Benzarti et al. (2020) show for the case of the Finnish hairdressing business, among others, that the pass-through of an industry-targeted decrease in value-added taxes is only half of the pass-through of the subsequent increase in value-added taxes. The effect is driven by firms with low profit margins.

5.1.4 Equilibrium

Each period t, the price of firm i is determined by its type (c_{it}, q_{it}, u_i) and its idiosyncratic cost component ζ_i. Each customer j of with information type $u(j)$ accounts for this and computes the expected price of firm i in period t as a function of the tuple (C_{it}, q_{it}, u_i). In periods without uncertainty, there are three firm types: low-cost, low-quality firms, high-cost, low-quality firms, and high-cost, high-quality firms. We denote the *median* equilibrium prices of these types as $\underline{p_{t,u}}$, $\overline{p_{t,u}}$, and $\overline{\overline{p_{t,u}}}$, respectively, where the firm's prices may also differ by their regular customer's information type u in periods with uncertainty, and the median is over the distribution of the idiosyncratic cost component.[24] We denote the corresponding expected customer surpluses of consuming at firms with these types that arise in equilibrium as $\underline{V_{t,u}}$, $\overline{V_{t,u}}$, and $\overline{\overline{V_{t,u}}}$.

In periods with uncertainty, the expected prices and surpluses $p_{it}^{u(j)}$ and $V_{it}^{u(j)}$ by cus-

[22] This can be shown with expected surpluses of monopolists, V_{it}^m. Combining equations (2) and (6), it holds that $V_{it}^m = \frac{((q_{it}-C_{it})/2)^2}{2q_{it}}$. The derivative of this surplus by marginal costs, $\partial V_{it}^m / \partial C_{it} = -\frac{1-C_{it}/q_{it}}{4}$, falls in the quality-cost ratio q_{it}/C_{it} of the firm, and thereby in its productivity/profitability.

[23] Note that if customers could credibly commit not to learn about industry-wide conditions from the firm's price decreases, this would be a Pareto improvement: customers would benefit from more pass-through of lower costs, while firms could freely set their lower monopoly price. A low but positive inflation rate of the overall consumption-basket could be such a commitment (or *obfuscation*) device: by keeping their nominal prices constant, firms could decrease their real prices over time, which may go unnoticed by customers who pay little attention to low inflation rates (Coibion and Gorodnichenko, 2015).

[24] Taking the median instead of the mean helps for the comparison with the data, where we take the median in order to be robust to outliers on the observed price distribution.

tomer j of information type $u(j)$ do not generally coincide with the equilibrium prices and surpluses. However, by the assumption of rational expectations, all customers' expectations must be consistent with *some* equilibrium. We will consider an equilibrium where customers who observe the idiosyncratic cost component of their regular firm can identify the industry-wide cost increase that induces the true equilibrium ($\gamma_i^1 = 1$ for all firms i with $u_i = 1$), while some customers without this information have the counterfactual belief that costs did not increase, and form expectations consistent with an alternative equilibrium ($\gamma_i^0 = 0$ for some firms i with $u_i = 0$). In order for the counterfactual belief to be rational, the support of the idiosyncratic cost component, $\left[\underline{\zeta}, \overline{\zeta}\right]$, has to be wide enough, which we assume (see below). For any customer j with information type $u(j) = 1$, it then holds that $p_{it}^1 = p_{it}$ and $V_{it}^1 = V_{it}$ for all firms i. The customers calculate their expected outside option in period t as the integral over all possible expected surpluses that they expect to obtain in equilibrium, as in (3). To be consistent, both the true as well as the counterfactual surpluses fulfill condition (9) for all firm types. The median of idiosyncratic prices (10) over $\mathbb{P}_\zeta$ yields the median prices that obtain in equilibrium from the expected customer surpluses of each firm type in the true equilibrium.

The expected mass of searching customers in equilibrium, $\mathcal{D}_t$, is equal to the expected mass of firms that do not retain their regular customers:

$$\mathcal{D}_t^{\tilde{u}} = \sum_{c \in \{\underline{c_t}^{\tilde{u}}, \overline{c_t}^{\tilde{u}}\}} \sum_{q \in \{\underline{q_t}, \overline{q_t}\}} \sum_{u \in \{0,1\}} \mathbb{P}[(c,q,u)] \int_{\underline{\zeta}}^{\overline{\zeta}} \mathbb{I}_{\left\{V^{*,\tilde{u}}_{(c,q,u,\zeta)t} < \mathbb{EV}_t^u - s \text{ or } c+\zeta > q\right\}} d\mathbb{P}_\zeta(\zeta). \tag{12}$$

In general, customers who form expectations consistent with the alternative equilibrium, where industry-wide costs did not increase, will expect a counterfactual mass of searching customers, denoted by $\mathcal{D}_t^0$. Firms on the other hand all observe the true cost shock, and hence all know the expected random demand of the actual equilibrium, $\mathcal{D}_t^1 = \mathcal{D}_t$. Customers do not observe which firms stay in the market or exit the market, so that they cannot learn about the true level of random demand, and by extension about industry-wide costs, from firms' decisions whether to produce. If their regular firm stays in business, customers with the low information type will in general assume that its idiosyncratic cost component is higher than it actually is.[25]

5.2 Model experiment

In the periods $t = 0$ and $t = 2$, all customers are perfectly informed about the baseline levels of the firms' costs, $\underline{c_t}$ and $\overline{c_t}$. We consider the experiment where the baseline production costs increase over time by a fixed amount $\kappa > 0$: $\underline{c_0} =: \underline{c} < \underline{c'} = \underline{c} + \kappa := \underline{c_1}$ and $\overline{c_0} =: \overline{c} < \overline{c}' = \overline{c} + \kappa := \overline{c_1}$. We assume that the customers know that any possible cost-increase is a fixed amount κ that is added to low or high baseline costs. Hence, customers who learn about the new level of the low baseline cost $\underline{c'}$ also learn about the new level of

[25]Note that there is no dynamic learning by the assumption that customers are replaced each period.

the high baseline cost, $\overline{c}'$. In the period $t = 1$, while baseline costs have already increased to $\underline{c}'$, low understanding customers instead believe that they are still at the level $\underline{c}$: $\underline{c}^0_{i1} = \underline{c}$ for some firms i. In period $t = 2$, all low understanding customers have learned the higher baseline cost-levels.[26]

With this industry-wide cost-shock, we aim to capture the adverse effect of the pandemic on the hairdressing-business in Germany between the years 2020 and 2021: first, mandatory hygiene- and distancing-measures that were in place during that time increased the marginal and fixed costs of producing haircuts for all kinds of hairdressers. Second, the two mandatory shutdowns that lasted several months also increased the ex-post fixed cost of running a hairdresser-business. Third, the federal minimum wage in Germany increased at the first of January 2021, and several federal states who have an independent minimum wage for the hairdresser industry increased it at that time as well.

5.2.1 Solving for an equilibrium

We look for an equilibrium of the model where the relative price distribution is as disperse as in the data, and the information type of the firm's customer imposes a constraint on the price-setting of at least some firm types in period $t = 1$. For measuring price dispersion in the model, we look at the dispersion of the median equilibrium prices across types, across firms that stay in business in that period. The three firm types that obtain in the model in periods without uncertainty induce a *fundamentals-based* order of relative prices, which can be derived from the monopoly prices in (6): low cost firms are the relatively cheapest, while high quality firms are the relatively most expensive. We match this fundamentals-based order to tertiles of the empirical relative price distribution. In the data, we observe relatively little transitions of firms across the tertiles over time.[27] Therefore, as an additional requirement, we only consider equilibria where the relative prices of firms of a given firm type conform to the fundamentals-based ordering of firm types.

Only a narrow set of equilibria fulfills these conditions: In period $t = 1$, the low baseline cost and the high quality firm types set their monopoly price, while the high baseline cost, low quality firm type is split into two: the median firm with low understanding customers that stays in business sets a price lower than its monopoly price in order to retain its regular customer, while the median firm with understanding customers that stays in business either sets its monopoly price, or a lower price, which is however still higher than that of the firm which is subject to less understanding customers.

The intuition for this result is the following: The search cost s is the main model parameter that we can vary to select equilibria. Trivially, with s large enough, all firm types can

[26] Modeling the dynamic learning of customers is beyond the scope of this paper. We could imagine that the customers learn over time by occasionally observing the prices of random firm types, or that customers with the lower information type learn over time from customers with the high information type.

[27] We find that the majority of firms (63% ±5%) remain in the same relative price tertile for all months between March 2020 and December 2021 (CPI micro-level data, N=89).

charge their monopoly price, which differs across cost-quality pairs, but not customer information types. Lowering s, the first firm type that is subject to real price rigidity is the one that offers the lowest expected surplus to customers relative to its search competition. Naturally, this is the case for the firms producing low quality goods or services at high baseline costs, and, in periods with uncertainty, those with less understanding customers. If s is low enough such that more than two firm types are restricted by search competition, the price distribution starts to collapse: all prices that are restricted by the same search competition are the same. While firms with different customer information levels face different search competitions, and the model in principle allows for infinitely many information levels, the learning rules from section 5.1.3 imply that information levels above some firm type-specific threshold $\underline{\gamma}_i$ allow firms to set their monopoly price, while for prices below that, customers remain at the lowest information level $\gamma = 0$.[28] As a consequence, only up to two firm types can be restricted and still set different prices.[29] Unless firms transition across tertiles, which we rule out, not more than two firm types can thus be restricted by search competition for the price distribution to remain dispersed.[30]

In order to solve for an equilibrium that fulfills the above criteria, we choose the search cost s between two bounds, which are determined by the equilibrium conditions of the high baseline cost, low quality, low understanding firm type in period $t = 1$, characterized as $(\overline{c_1}, \underline{q_1}, 0)$. The upper bound on s binds when the median firm of this type can set its price at the monopoly price level. At that point, differences in customers' beliefs do not imply differences in (median) prices, which is contrary to our interpretation of the data. The lower bound on s binds when *from the perspective of* low understanding customers firms of this type with the highest idiosyncratic cost level are on the brink of stopping production. For lower s, low understanding customers would rationally expect to only observe firms of that type in period t with idiosyncratic costs up to a bound smaller than $\overline{\zeta}$. Then, they would follow a different learning rule than the one we describe in section 5.1.3. We choose to set s equal to this lower bound.

In appendix D, we describe the numerical algorithm we use to solve the model for each period and numerically check the requirements on the equilibrium. In particular, we check that for our calibration, the chosen s fulfills two requirements: in uncertainty period $t = 1$, the low understanding customers of firms that are search-restricted in their price setting rationally expect firms with *high* understanding customers to be search-restricted as well,

[28] We restrict ourselves to equilibria where $\gamma_i^1 = 1$ and $\gamma_i^0 \in \{0\} \vee [\underline{E}, \overline{E}], \underline{E}, \overline{E} \in (0, 1)$ for all firms i; see appendix D.

[29] This result could be attenuated by considering finite firm size, which would induce different search competition for firms with different cost-quality pairs.

[30] With transitions across tertiles, one could for example have an equilibrium where the median high quality firm with low understanding customers is search-restricted, while the median high quality firm with high understanding customers can charge its monopoly price. In this situation, low quality firms with high baseline costs and high understanding customers would charge more than some firms who offer a high quality product, so that the fundamentals-based order of firm types on the relative price distribution would be violated.

Parameter	Value	Matched data moment
$\underline{c}$	1	- (normalization)
$\overline{c}$	1.55	relative price dispersion December
$\underline{q}$	1.99	relative price dispersion December
$\overline{q}$	2.53	relative price dispersion December
κ	0.18	relative price increases March
$\overline{\zeta}$	0.21	relative price gap March
α	0.45	survey evidence
s	2.88%	choice of equilibrium

Table 7: Calibration of model parameters.

since they believe that industry-wide conditions have not changed from last period. At the same time, all firms with high understanding customers in fact have monopoly power in that period, unless their costs exceed their quality, at which point they exit the market. By proposition 5.1, this ensures that all customers of the high information type learn the true industry-wide cost increase in the uncertainty period ($\gamma_i^1 = 1$). At the same time, we check that firms with high costs, low quality, and low understanding customers, whose idiosyncratic costs ζ_i are in the interval $[\underline{\zeta}_1^*, \overline{\zeta}_1^*]$, are restricted to set their price equal to the outside option of their customer. Firms with even lower costs, $\zeta_i < \underline{\zeta}_1^*$, are able to charge their monopoly price, while their low understanding customers still do not learn about the cost increase. Firms with higher costs $\zeta_i > \overline{\zeta}_1^*$ either exit the market or (at another threshold, $\zeta_i > \overline{\zeta}_1^E$) signal higher industry-wide costs by charging their monopoly prices. We calibrate the model to the targeted data moments by numerically minimizing the sum of squared deviations from the targeted data moments over the parameter space.

5.2.2 Calibration and Results

We have two main calibration targets: the dispersion of the relative price distribution for the December 2020-prices of our survey participants, and the heterogeneous relative price increases from December 2020 to March 2021 across the relative price distribution. For these data moments, we construct the relative prices of hairdressers in our survey as described in section 2. Then, we split the relative price distribution of December 2020, pooled across all surveyed counties with at least 6 firms, into tertiles. We find that the median price of firms in the first tertile is 14.7pp lower than the median price of the overall distribution, while the median price of firms in the third tertile is 16.7pp higher than the median price. Our calibration matches this dispersion quite well: the median firm in the first relative price-tertile, which is of the low cost-type, prices 14.8pp below the median price, while the median firm in the third tertile, which is of the high quality-type, prices 16.3pp above the median price.

Next, we calibrate the changes in costs and quality to the observed relative price changes from December 2020 to March 2021, which we define as the percentage change in relative prices between these two periods. We average these price changes over firms in the tertiles

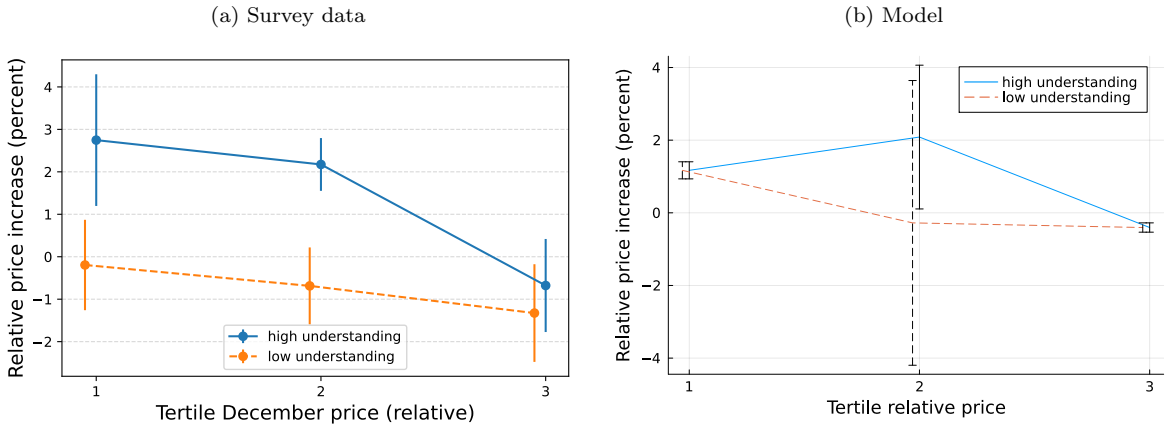


Figure 6: Relative price increases over the relative price distribution and by understanding-type. For the survey data, the increase is from December 2020 to March 2021. The difference between the two understanding-types is only statistically significant for the second tertile (two-sample t-test, standard errors clustered at the county level; p=2%, $N_L = 16$ (13 cluster), $N_H = 25$ (15 cluster)). The whiskers denote 68% confidence intervals (left) and 68% coverage intervals (right).

of the relative price distribution of December 2020. In the data, we find a significantly lower relative price change from the second to the third tertile among firms with high understanding customers (see the left panel of figure 6), where the firms in the middle tertile increase their relative price by about 2.5pp more. We find a similar, statistically significant gap between the relative price changes of firms with high understanding and firms with low understanding customers within the second tertile. In other tertiles, differences in the level of customer understanding do not lead to significantly different relative price changes. Our calibrated model likewise generates gaps of 2.5pp between the second and third tertile and 2.4pp between firms with high and low understanding firms in the second tertile (right panel of figure 6). The relative price increase declines over the relative price distribution, since for expensive firms in the upper tertile, the industry-wide cost increase by the fixed amount κ makes up a lower share of their higher baseline cost than for the cheaper firms in the lower tertile. The reason for the gap between firms who have customers with different information types is as discussed above: customers who observe the idiosyncratic costs can learn about the industry-wide cost increase, and as consequence their firms can charge their monopoly prices, while customers who do not have this information learn about the cost increase to a much lesser extent, and force their regular firms to either increase their price by less, or to exit the market.[31]

An important parameter of the model is the share of customers of the high information type, α. We estimate it from the share of firms who report a high understanding of prices by their customers in the third tertile. We do not estimate the share from all tertiles, since our model predicts that firms in the second tertile with low understanding customers disproportionally exit the market, which would downward bias our estimate. The dispersion of idiosyncratic costs, which are distributed uniformly and symmetrically around 0, is

[31]Our model predicts that 2.9% of firms exit the market during the uncertainty period $t = 1$, while no firms exit in the periods $t = 0$ and $t = 2$.

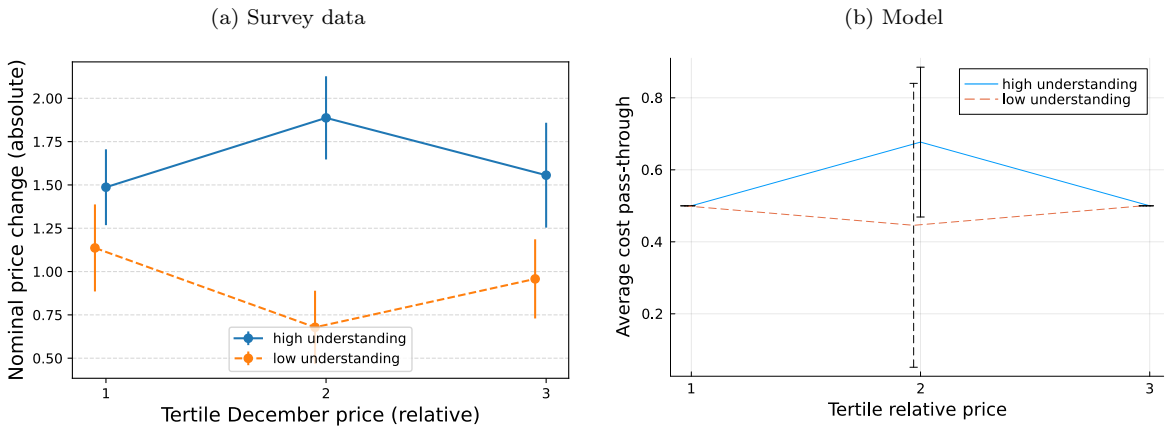


Figure 7: Nominal price increase in Euros (left) and cost pass-through (right) over the relative price distribution and by understanding-type. For the survey data, the increase is from December 2020 to March 2021. The difference between the two understanding-types is only statistically significant for the second tertile (two-sample t-test, standard errors clustered at the county level; p=0%, $N_L = 17$ (14 cluster), $N_H = 25$ (15 cluster)). The cost pass-through is defined as $(p_1 - p_0)/(C_1 - C_0)$. The whiskers denote 68% confidence intervals (left) and 68% coverage intervals (right).

determined by the distribution's upper bound, $\overline{\zeta}$. We calibrate it so that the real upward price rigidity from having a low understanding customer is as strong as in the data. Comparing the model's coverage intervals (right panel of figure 6) with the confidence intervals of the mean relative price increases in the data (left panel) shows that the model-implied dispersion of relative price increases is too large. This is a consequence of our assumption of rational customers, who try to learn from prices about industry-wide conditions. Only a large heterogeneity in firms' idiosyncratic costs can prevent low understanding customers from learning about the industry-wide cost increase. If we assumed that customers did not know the distribution of idiosyncratic costs, low understanding customers could not learn anything from prices, which would give the model another degree of freedom to match the observed heterogeneity in price increases as well. Here, we aim to match only the average gap between firms with high and low understanding customers.

In terms of nominal prices, the model predicts an average nominal price increase of 5.5%, which is in line with the 5.7% (± 0.4%, N=281) nominal increase of the firms in our survey, even though it was not a target of the calibration exercise. The model also predicts that, as in the data[32], no firm decreases its nominal price. Nominal price stickiness is small, however: only 1.8% of firms keep their price at the same level, which is an order of magnitude lower than in the survey data. The reason is that there is not a lot of overlap on the idiosyncratic cost distribution of firms that are search-restricted in their price-setting in both periods $t = 0$ and $t = 1$. Firms with relatively high idiosyncratic costs are search-restricted in period $t = 0$, but in period $t = 1$, if the firms have low-understanding customers, they either have to exit the market, or can set a monopoly price that is high enough so that their customers will learn (some) of the industry-wide cost increase.

[32]One out of 282 firms in our survey reported a nominal price decrease from December 2020 to March 2021.

Source	α	Relative price changes over tertiles	$\sigma(\Delta p)$	$\sigma(p)$
Model	0.0	$(0.2\%, 1.11\%, -1.38\%)$	0.8%	11.3%
Model	0.45	$(1.17\%, 1.15\%, -0.40\%)$	1.1%	11.4%
Model	0.9	$(6\%, 4.86\%, 4.43\%)$	2.9%	12%
Survey (unc.)	-	(1.95% ±1.0%, 0.88% ±1.2%, -0.91% ±0.8%)	-	17.7%
Survey (con.)	-	(4.97% ±1.1%, 2.99% ±1.5%, 2.33% ±1.4%)	-	-
CPI (unc.)	-	(-2.21% ±1.4%, -4.11% ±1.4%, -5.85% ±1.7%)	-	23.1%
CPI (con.)	-	(6.55% ±2.1%, 3.33% ±1.4%, 4.03% ±1.4%)	7.5%	-

Table 8: Average relative price changes over the relative price distribution and the standard deviation of conditional relative price changes in model and data. For the distribution, the position in the tuple represents the tertile-number. For the survey, the relative price distribution is from December 2020, while for the CPI-micro data, it is from March 2020. "unc." and "con." refer to unconditional relative price changes or changes conditional on firms adjusting their nominal price, respectively. $\sigma(\Delta p)$ refers to the SD of *conditional price changes* relative to the median, while $\sigma(p)$ refers to the SD of *prices* relative to the median. Standard errors of survey data are clustered at the county-level, and sample sizes are $N = 189$ (unc.) and $N = 121$ (con.). The unconditional CPI-results denote averages from March 2020 to March 2021, with sample size $N = 103$. The conditional CPI-results denote the average montly change from January 2020 to December 2021, conditional on a nominal price adjustment, and control for county fixed effects and a measure of nominal price-stickiness, with sample size $N = 86$.

Figure 7 shows the absolute nominal price increase of the hairdressers in our survey over the relative price distribution and by customer understanding (left panel). The absolute price increase is a scaled measure of cost pass-through under the maintained assumption that the cost increased by the same fixed amount for all firms. Under that assumption, the model matches the data qualitatively *and* quantitatively (see right panel of figure 7). To see the latter point, we can use our survey participants' report on the hygiene surcharge as a measure for the increase in marginal costs due to the hygiene measures (see table 1), which lies at 2.38 Euro ± 10 Eurocents. The model predicts that monopolists pass through half of the cost increases, as they find it optimal to reduce their markup in order to attract more customers (see equation (6)). If we bring this together with our measure of the cost increase, we expect monopolists to increase their price by about 1.20 Euro on average. This is in line with the data. The cost pass-through diverges for less productive firms in the middle of the price distribution for two reasons: as their customers' outside option falls with the industry-wide cost increase, firms with high-understanding customers that were search-restricted in their pricing in period $t = 0$ now can set their monopoly price; hence, they increase the markup on their product. Meanwhile, firms with low-understanding customers that were monopolists in period $t = 0$ are restricted by the fact that their customers do not update their beliefs about their outside option; hence, they reduce their markup by more than monopolists. Quantitatively, the average gap between firms with high- and low-understanding customers is a little wider in the data than in the model.

Table 8 shows the effects of a change in the share of low understanding customers, α, on the average relative price changes by tertile. It is clear that with more low understanding customers, the real price rigidity affects more firms in the middle of the relative price distribution, lowering the average relative price increase in the second tertile. We also

calculate the standard deviation of relative price changes *conditional* on price changes for each firm over time, denoted as $\sigma(\Delta p)$, as in Klenow and Willis (2016). In the context of the model, we treat the relative prices of firms in period $t = 0$ as resulting from a price change. Therefore, even for firms who do not change their prices from periods $t = 1$ to $t = 2$, the standard deviation is well defined. Instead, among high cost, low quality firms with low understanding customers, firms who are constrained in their pricing in period $t = 1$ change their price also from period $t = 1$ to $t = 2$, as period $t = 2$ is a certainty period when their customers learn about the higher industry-wide cost. Table 8 shows that this measure of real rigidities varies quite strongly with different incidences of customer understanding. When 90% of firms in the market have low understanding customers, we can explain 39% of the fluctuations of conditional relative price changes over time of firms in the CPI data. In comparison, the standard deviation of relative prices (not price *changes*), denoted as $\sigma(p)$, does not change that much with the share of firms with low understanding customers. This shows that the restrictedness of unproductive firms in an uncertainty period changes the relative prices of more productive firms more strongly *over time* than within the period. Instead, we find that the increased standard deviation of firms who also change their prices from period $t = 1$ to $t = 2$ has a negligible impact on the result. The model explains only about half of the overall price dispersion that we see in the data. The reason is that, by postulating a uniform distribution of idiosyncratic costs, we abstract from prices in the tails of the empirical price distribution.

In the remaining rows of table 8, we report the distribution of relative price changes from different data sources, and measured unconditionally or conditionally on a nominal price adjustment. While we match our model to the unconditional relative price changes of firms in our survey, conditional relative price changes as proposed in the literature (Klenow and Willis, 2016) offer a way to disentangle real from nominal price stickiness. Notably, the gap between unconditional and conditional relative price changes is larger in the CPI than in the survey data. This confirms the result from section 2 that the respondents in our survey are subject to less nominal price stickiness than the firms sampled by the German statistical offices. Still, the pattern that the size of relative price increases falls in the initial relative price position of the firm is consistent and significant across all measures, and can be explained by our model when the share of firms with low understanding customers is sufficiently large.

6 Conclusion

In this paper, we present the case that customer markets with information asymmetries are an important source of price dispersion and relative price fluctuations in firm pricing. First, we conduct a survey among German hairdressers during the Covid-19 pandemic, asking about their reasons for setting their prices. Then, we take the hairdressers at their word and build a model that matches the results of our survey both qualitatively and quantitatively.

The key to our interpretation of the data is that the Covid-19 pandemic induced uncertainty about firms' production costs on the side of the customer. Therefore, our survey produces clear results about the importance of retaining one's regular customer when setting one's prices, and about the importance of the customers' understanding for the firm's prices. With the supply-chain disruptions during the pandemic and the energy crisis as a consequence of the war in the Ukraine, there is reason to believe that uncertainty about supply-side conditions can explain a sizable share of recent price dispersion in other industries as well, given our model. The fact that our survey results are in line with the numerable literature on surveying managers about pricing gives us confidence about the external validity of the mechanism we propose. We view as one of our main contributions to the literature that we explain the heterogeneity in price rigidity due to low customer understanding in a model with rational customers and profit-maximizing firms that fits the data quantitatively well.

The main factor that we do not microfound in our model is why firms have low or high understanding customers. However, we provide evidence from our survey data that firms with more employees are more likely to have low understanding customers. As a next step, we would therefore like to investigate the properties of our model in a dynamic setting with firm investment. In the context of the search model, this would necessitate to introduce directed search into the theory. Then, firms would trade-off building a customer base by setting low prices (see Foster et al. (2016) for empirical evidence for this) with growing large, and being possibly more at risk of future price rigidity due to low customer understanding.

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A Details on the Other Surveys on Price Stickiness

After Blinder et al. (1998), the Inflation Persistence Network of the European Central Bank has conducted similar surveys in many European countries: Austria (Kwapil et al., 2005), Belgium (Aucremanne and Druant, 2005), France (Loupias and Ricart, 2004), Germany (Stahl, 2005), Italy (Fabiani et al., 2004), Luxembourg (Lünnemann and Mathä, 2006), the Netherlands (Hoeberichts and Stokman, 2006), Portugal (Martins, 2005), and Spain (Álvarez and Hernando, 2005). Their results are summarized in the meta study by Fabiani et al. (2006). Independent researchers have also conducted similar studies in other countries: the United Kingdom (Hall et al. 2000 and Greenslade and Parker 2012), Japan (Nakagawa et al., 2000), Canada (Amirault et al., 2006), Sweden (Apel et al., 2005), Norway (Langbraaten et al., 2008), Romania (Copaciu et al., 2010), Estonia (Dabušinskas and Randveer, 2006), Turkey (Sahinoz and Saraçoğlu, 2008), Pakistan (Malik et al., 2008), Poland (Jankiewicz and Kolodziejczyk, 2008), Iceland (Ólafsson et al., 2011), Lithuania (Virbickas, 2011), New Zealand (Parker, 2014), Brazil (Correa et al., 2018), Tanzania (Kimolo, 2018), and Vietnam (Pham et al., 2019).

The following tables summarize the results of these studies. Because both the selection of hypotheses and their number differ across the studies, we categorized the hypotheses in 8 categories and color-coded the rankings to make them better comparable. We also added short descriptions of the theories underlying the hypotheses. The tables list the authors of a study, where the results are published, when and where the survey was conducted, how many managers responded, what kind of survey it is, the scale on which hypotheses are rated, and their ranking. We interpreted all hypotheses that are referred to as "kinked-demand curve" as coordination failure, and we excluded the hypotheses for why prices are increased (instead of why prices are sticky) in Loupias and Ricart (2004).

	Authors (Source)	Blinder, Canetti, Lebow, Rudd (1998 Monography)	Hall, Walsh, Yates (2000 Oxford Economic Papers)	Nakagawa, Hattori, Takagawa (2000 Bank of Japan Working Paper)
	Country (Year of Survey)	United States (1990-1992)	United Kingdom (1995)	Japan (2000)
	Responses	200	654	630
	Small firms excluded?	> $10 million revenue	unclear	In First Section of Tokyo Stock Exchange
	Kind of survey	structured interview	paper questionnaire after agreeing to participate	paper questionnaire
	Hypotheses and Ranking	Scale: 1 to 4	Scale: 7 to 1	Scale: 5 to 1
1		Coordination failure (2.77)	Explicit contracts (2.2)	Coordination failure (2.86)
2		Cost-based pricing (2.66)	Cost-based pricing (2.3)	Implicit contracts (2.86)
3		Nonprice competition (2.58)	Coordination failure (2.5)	Explicit contracts (3.10)
4		Implicit contracts (2.40)	Pricing points (2.8)	Pricing points (3.60)
5		Explicit contracts (2.11)	Implicit contracts (2.9)	Nonprice competition (3.61)
6		Costly price adjustment (1.89)	Constant MC (3.1)	Procyclical elasticity (3.99)
7		Procyclical elasticity (1.85)	Inventories (3.1)	Menu costs (4.18)
8		Pricing points (1.76)	Nonprice competition (3.3)	Judging quality by price (4.23)
9		Constant MC (1.57)	Procyclical elasticity (3.3)	Delivery lags/service (4.35)
10		Inventories (1.56)	Judging quality by price (3.6)	
11		Hierarchy (1.41)	Physical menu costs (3.8)	
12		Judging quality by price (1.33)		
13				
14				
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Authors (Source)	Amirault, Kwan, Wilkinson (2006 Bank of Canada Working Paper)	Apel, Friberg, Hallsten (2005 Journal of Money, Credit and Banking)	Langbraaten, Nordbø, Wulfsberg (2008 Norges Bank Economic Bulletin)
Country (Year of Survey)	Canada (2002-2003)	Sweden (2000)	Norway (2007)
Responses	170	48.7% of 1285	725
Small firms excluded?	> 20 employees	> 5 employees	no
Kind of survey	structured interview	paper questionnaire	paper questionnaire
Hypotheses and Ranking	Scale: 0 or 1	Scale: 1 to 4	Scale: 1 to 4 (scores not reported)
1	Cost-based pricing (67.1%)	Implicit contracts (3.00)	Explicit contracts
2	Customer relations (55.3%)	Cost-based pricing and constant MC (2.45)	Coordination failure
3	Explicit contracts (45.3%)	Explicit contracts (2.27)	Customer relationship
4	Nonprice competition (44.1%)	Kinked demand curve (coordination failure) (2.17)	Pricing points
5	Coordination failure upwards (41.2%)	Countercyclical cost of finance (2.08)	Costly information Menu costs
6	Low inflation (33.5%)	Liquidity constraints (1.85)	
7	Implicit contracts (31.8%)	Pricing points (1.85)	
8	Coordination failure downwards (31.2%)	Procyclical elasticity (1.75)	
9	Factor stability (31.2%)	Deviation from collusion (1.68)	
10	Menu costs (21.2%)	Thick market (supply side) (1.60)	
11	Sticky information (13.5%)	Physical menu costs (1.54)	
12		Thick market (demand side) (1.50)	
13		Information costs (1.40)	
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Authors (Source)	Inflation Persistence Network Meta-Study (2006 International Journal of Central Banking)	Kwapil, Scharler, Baumgartner (2005 European Central Bank Working Paper)	
Country (Year of Survey)	EU (2003-2004)	Austria (2004)	
Responses	more than 11000	873	
Small firms excluded?	differs across countries	In WIFO Business Cycle Survey	
Kind of survey	differs across countries	paper questionnaire	
Hypotheses and Ranking	Scale: 1 to 4 (unweighted averages of country scores)	Scale: 1 to 4 Increases only	Scale: 1 to 4 Decreases only
1	Implicit contracts (2.7)	Implicit contracts (3.04)	Implicit contracts (3.04)
2	Explicit contracts (2.6)	Explicit contracts (3.02)	Explicit contracts (2.94)
3	Cost-based pricing (2.6)	Cost-based pricing (2.72)	Kinked demand curve (2.69)
4	Coordination failure (2.4)	Kinked demand curve (2.69)	Cost-based pricing (2.49)
5	Judging quality by price (2.1)	Coordination failure (2.47)	Coordination failure (2.13)
6	Temporary shocks (2.0)	Information costs (1.61)	Nonprice competition (1.98)
7	Nonprice competition (1.7)	Menu costs (1.52)	Judging quality by price (1.88)
8	Menu costs (1.6)	Nonprice competition (1.49)	Temporary shocks (1.470
9	Costly information (1.6)	Temporary shocks (1.42)	Information costs (1.61)
10	Pricing points (1.6)	Pricing points (1.32)	Menu costs (1.52)
11		Judging quality by price (not applicable)	Pricing points (1.24)
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Authors (Source)	Aucremanne, Druant (2005 European Central Bank Working Paper)	Loupias, Ricart (2004 European Central Bank Working Paper)	
Country (Year of Survey)	Belgium (2004)	France (2003-2004)	
Responses	1979	1662	
Small firms excluded?	In monthly survey of the National Bank of Belgium	unclear	
Kind of survey	paper questionnaire	face-to-face, phone, mail	
Hypotheses and Ranking	Scale: 1 to 4	Scale: 1 to 4 Increases only	Scale: 1 to 4 Decreases only
1	Implicit contracts (2.5)	Cost-based pricing (3.0 commodity prices) (2.5 labor cost) (1.8 productivity)	Explicit contracts (2.5)
2	Explicit contracts (2.4)	coordination failure (3.0 others don't change) (2.3 match others' prices)	Cost-based pricing (2.6 commodity prices) (1.9 labor cost) (2.2 productivity)
3	Cost-based pricing and constant MC (2.4)	Explicit contracts (2.7)	coordination failure (2.8 match others' prices) (2.1 others don't change)
4	Liquidity constraints (2.2)	Implicit contracts (2.2)	Negative demand shock (2.3)
5	Kinked demand curve (2.2)	Temporary shocks (2.1)	Temporary shocks (2.1)
6	Procyclical elasticity (2.1)	Positive demand shock (2.0)	Implicit contracts (2.0)
7	Thick market (demand side) (2.0)	Fewer competitors (1.8)	More competitors (2.0)
8	Judging quality by price (1.9)	Pricing points (1.7)	Pricing points (1.6)
9	Thick market (supply side) (1.8)	Inventory + delay (1.4)	Inventory + delay (1.6)
10	Temporary shock (1.8)	Physical menu costs (1.4)	Physical menu costs (1.4)
11	Nonprice competition (1.7)		
12	Countercyclical cost of finance (1.7)		
13	Pricing points (1.7)		
14	Information costs + bureaucracy (1.6)		
15	Menu costs (1.5)		

Authors (Source)	Fabiani, Gattulli, Sabbatini (2004 European Central Bank Working Paper)	Stahl (2005 European Central Bank Working Paper)	
Country (Year of Survey)	Italy (2003)	Germany (2004)	
Responses	333	1200	
Small firms excluded?	> 50 employees	In survey of Ifo institute	
Kind of survey	paper questionnaire	paper questionnaire	
Hypotheses and Ranking	Scale: 1 to 4	Scale: 1 to 4 Increases only	Scale: 1 to 4 Decreases only!
1	Explicit contracts (2.64)	Coordination failure (2.6)	Explicit contracts (2.4)
2	Coordination failure (2.59)	Explicit contracts (2.4)	Coordination failure (2.2)
3	Temporary shocks (1.97)	High elasticity for increases (2.1)	Low elasticity for decreases (2.1)
4	Menu costs (1.58)	Regular date (2.0)	Temporary shock (2.0)
5	Pricing points (1.43)	Regular interval (1.9)	Regular date (2.0)
6	Bureaucratic costs 1.30	Temporary shock (1.8)	Regular interval (1.9)
7		Sluggish costs (1.8)	Sluggish costs (1.8)
8		Menu costs (1.4)	Menu costs (1.4)
9		„Other“ (1.1)	„Other“ (1.1)
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Authors (Source)	Lünnemann, Mathä (2006 European Central Bank Working Paper)	Alvarez, Hernando (2005 European Central Bank Working Paper)	
Country (Year of Survey)	Luxemburg (2004)	Spain (2004)	
Responses	367	2008	
Small firms excluded?	> 5 employees	> 5 employees	
Kind of survey	paper questionnaire	paper questionnaire	
Hypotheses and Ranking	Scale: 1 to 4 (scores not reported)	Scale: 1 to 4 Increases only	Scale: 1 to 4 Decreases only
1	Implicit contracts	Implicit contracts (2.56)	Coordination failure (2.21)
2	Constant MC	Coordination failure (2.42)	Explicit contracts (2.09)
3	Explicit contracts	Explicit contracts (2.25)	Temporary shocks (1.82)
4	Procyclical elasticity	Temporary shocks (1.82)	Judging quality by price (1.82)
5	Thick markets (demand)	Pricing points (1.49)	Pricing points (1.42)
6	Liquidity constraints	Menu costs (1.43)	Menu costs (1.39)
7	Judging quality by price	Nonprice competition (1.34)	Nonprice competition (1.34)
8	Thick markets (supply)	Costly information (1.33)	Costly information (1.30)
9	Coordination failure	Judging quality by price (not applicable)	Implicit contracts (not asked)
10	Pricing points		
11	Temporary shock		
12	Countercyclical cost of finance		
13	Menu cost		
14	Nonprice competition		
15	Costly information		

	Authors (Source)	Hoeberichts, Stokman (2006 European Central Bank Working Paper)	Martins (2005 European Central Bank Working Paper)	Copaciu, Neagu, Braun-Erdei (2010 Managerial and Decision Economics)
	Country (Year of Survey)	Netherlands (2004)	Portugal (2004)	Romania (2006)
	Responses	1246	1370	377
	Small firms excluded?	no	> 20 employees	> 10 employees
	Kind of survey	email	paper questionnaire	unclear
	Hypotheses and Ranking	Scale: 1 to 4	Scale: 1 to 4	Scale: 1 to 4
1		Implicit contracts (2.66)	Implicit contracts (3.14)	Implicit contracts (3.12)
2		Explicit contracts (2.57)	Coordination failure (2.84)	Explicit contracts (3.10)
3		Judging quality by price (2.34)	High fixed costs (=liquidity constraints) (2.80)	Judging quality by price (2.19)
4		Temporary shocks (2.34)	Constant MC (2.70)	Price readjustments (2.15)
5		Coordination failure (2.22)	Explicit contracts (2.63)	Coordination failure (1.97)
6		Nonprice competition (2.07)	Procyclical elasticity (2.61)	Costly information (1.74)
7		Pricing points (1.80)	Temporary shock (2.46)	Menu costs (1.62)
8		Menu costs (1.71)	Bureaucratic delays (2.45)	
9			Judging quality by price (2.28)	
10			Menu costs (1.89)	
11			Pricing points (1.78)	
12			Costly information (1.70)	
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Authors (Source)	Dabušinskas, Randveer (2006 Bank of Estonia Working Paper)		Sahinoz, Saraçoğlu (2008 Developing Economies)
Country (Year of Survey)	Estonia (2005)		Turkey (2005)
Responses	208		999
Small firms excluded?	no		unclear
Kind of survey	internet survey		unclear
Hypotheses and Ranking	Scale: 1 to 4 Increases only (scores not reported)	Scale: 1 to 4 Decreases only (scores not reported)	Scale: 0 to 3 and *100
1	Implicit contracts	Cost-based pricing	Constant markup (44.8)
2	Explicit contracts	Implicit contracts	Temporary shocks (40.6)
3	Cost-based pricing	Judging quality by price	Explicit contracts (37.1)
4	Coordination failure	Coordination failure	Implicit contracts (36.9)
5	Pricing points	Explicit contracts	Coordination failure (30.8)
6	Nonprice competition	Nonprice competition	Constant MC (22.6)
7	Costly information	Pricing points	
8	Menu costs	Menu costs	
9		Costly information	
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Authors (Source)	Greenslade, Parker (2012 Economic Journal)		Malik, Satti, Saghir (2008 Pakistan Development Review)
Country (Year of Survey)	United Kingdom (unclear)		Pakistan (2008)
Responses	693		343
Small firms excluded?	unclear		> 10 employees
Kind of survey	unclear		structured interview
Hypotheses and Ranking	Scale: 0 to 1 Increases only	Scale: 0 to 1 Decreases only	Scale: 1 to 4
1	Coordination failure (60%)	Coordination failure (35%)	Implicit contracts (framed as „customers prefer stable prices“) (2.66)
2	It would anger customers (56%)	Explicit contracts (35%)	Explicit contracts (2.41)
3	Explicit contracts (47%)	Implicit contracts (29%)	Coordination failure (2.35)
4	Implicit contracts (38%)	Temporary shocks (28%)	Temporary shocks (1.84)
5	Temporary shocks (32%)	Constant MC (26%)	Judging quality by price (1.84)
6	Constant MC (31%)	It would anger customers (25%)	Costly information (1.62)
7	Pricing points (24%)	Pricing points (15%)	Menu costs (1.59)
8	Menu costs (10%)	Menu costs (9%)	
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Authors (Source)	Jankiewicz, Kolodziejczyk (2008 Bank i Kredyt)		Ólafsson, Pétursdóttir, Vignisdóttir (2011 Central Bank of Iceland Working Paper)
Country (Year of Survey)	Poland (2006)		Iceland (2008)
Responses	752		580
Small firms excluded?	unclear		> 3 employees
Kind of survey	unclear		structured interview
Hypotheses and Ranking	Frequency top two answers Increases only	Frequency top two answers Decreases only	Assign 100 to one and 50 to another hypothesis (some not reported)
1	Coordination failure (53.4%)	Temporary shocks (33.5%)	Implicit contracts (34.1)
2	Explicit contracts (40.5%)	Explicit contracts (30.8%)	Explicit contracts (31.0)
3	Temporary shocks (22.0%)	None (29.0%)	Temporary shocks (28.8)
4	None (17.1%)	Other (22.1%)	Coordination failure (26.1)
5	Other (15.7%)	Judging quality by price (19.1%)	Pricing points (15.0)
6	Formal and legal difficulties (7.3%)	Pricing points (5.3%)	Menu costs
7	Pricing points (misreported) 3.8??	Formal and legal difficulties (3.2%)	Nonprice competition
8	Menu costs (1.4%)	Menu costs (2.0%)	Judging quality by price
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Authors (Source)	Virbickas (2011 Bank of Lithuania Working Paper)		Parker (2014 Reserve Bank of New Zealand Discussion Paper)
Country (Year of Survey)	Lithuania (2008)		New Zealand (2010)
Responses	343		5369
Small firms excluded?	> 5 employees		> NZD 30,000 revenue and > 5 employees
Kind of survey	unclear		unclear
Hypotheses and Ranking	Scale: 1 to 4 and then frequency of 3 and 4 Increases only	Scale: 1 to 4 and then frequency of 3 and 4 Decreases only	Scale: 0 to 1 (scores not reported)
1	Cost-based pricing (74.2%)	Cost-based pricing (61.7%)	Explicit contracts
2	Explicit contracts (63.2%)	Explicit contracts (51.1%)	Implicit contracts
3	Implicit contracts (50.9%)	Temporary shocks (50.9%)	Coordination failure
4	Coordination failure (41.1%)	Judging quality by price (48.1%)	Temporary shocks
5	Costly information (40.5%)	Coordination failure (37.8%)	Pricing points
6	Temporary shocks (33.4%)	Costly information (30.2%)	Nonprice competition
7	Pricing points (21.5%)	Nonprice competition (27.4%)	Menu costs
8	Nonprice competition (18.3%)	Pricing points (19.6%)	
9	Menu costs (17.0%)	Menu costs (16.4%)	
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	Authors (Source)	Correa, Petrassi, Santos (2018 Journal of Business Cycle Research)	Kimolo (2018 Journal of Economics and Sustainable Development)	Pham, Nguyen, Nguyen (2019 working paper)
	Country (Year of Survey)	Brazil (2011-2012)	Tanzania (2014)	Vietnam (2014)
	Responses	7002	79	1560
	Small firms excluded?	unclear	> 10 employees and > 7 years old	unclear
	Kind of survey	unclear	structured interview	unclear
	Hypotheses and Ranking	Unclear (Authors' ranking)	Scale: 5 to 1	not reported
1		Menu cost and costly information (46.7%)	Implicit contracts (2.00)	
2		Cost-based pricing (79.4%)	Explicit contracts (2.70)	
3		Explicit contracts (20%[sic])	Pricing points (2.94)	
4		Implicit contracts and not antagonizing customers (79%)	Judging quality by price (3.14)	
5		Coordination failure (67%)	Coordination failure (3.28)	
6		Non-price competition (75% - 54%)	Nonprice competition (3.33)	
7		Judging quality by price (38.3%)	Menu Costs (3.53)	
8			Temporary shocks (3.68)	
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List of Categories and Their Hypotheses

	There is no reason to change the prices	
1	Constant MC	The supply is perfectly elastic in the relevant range.
2	Factor stability	Nothing changes, so there is no reason to change the prices.
3	Low inflation	The price leves does not change, so there is no reason to change the prices.
	Rules (of thumb) how prices are set	
4	Regular date	Prices are only changed on specific dates.
5	Regular interval	Prices are only changed after specific (potentially stochastic) intervals
6	Cost-based pricing	Price = Piece cost + markup
7	Pricing points	Exploit the leading digit bias of the consumers (e.g. let prices end in .99).
8	Constant markup	Change the price only if the (real) mark-up falls out of a pre-specified range.
9	Explicit contracts	Long-term contracts with customers fix the prices (potentially pegged to inflation measures).
	Customer goodwill	
10	Implicit contracts	Invisible handshake: Customers want stable prices to reduce uncertainty and to be regular customers.
11	Customer relations	Don't want to lose customers' goodwill.
	Market environment changes in cycles	
12	Countercyclical cost of finance	In recessions, financing costs are larger, so prices are not reduced.
13	Liquidity constraints	Firms have to recoup their fixed costs, so they cannot reduce prices too much in recessions.
14	Procyclical elasticity	The mark-up changes over the cycle because the elasticity changes (e.g. in recessions only loyal people buy).
15	Thick market (demand side)	In booms, people buy more, so searching for cheaper prices becomes worthwhile.
16	Thick market (supply side)	In booms, firms can reach customers easier and get more demand by not increasing their prices.
	Competition	
17	Coordination failure (upwards)	The first firm to increase the price gets punished by the customers' leaving.
18	Coordination failure (downwards)	Decreasing the price starts a price war.
19	Deviation from collusion	Decreasing the price breaks the collusion and leads to punishment.
	Adjustment costs	
20	(Physical) Menu costs	Changing the price incurs costs directly.
21	Costly information	Gathering information and making decisions is costly.
22	Hierarchy	Within the firm, consensus has to be reached.
23	Formal and legal difficulties	Price changes might have to be justified.
24	Temporary shocks	To save adjustment costs, the price might not be changed if the optimal price will revert soon.

	Adjust other things than price	
25	Nonprice competition	Change other things than the price. E.g. increase delivery lags instead of increasing the price.
26	Inventories	Keep a stock to satisfy excess demand and build up a stock if demand is low.
	Asymmetric information	
27	Judging quality by price	If the price goes down, people think that the quality went down.

B Questionnaire

The following is the translation of our survey into English. Below the translation is the German original.

English Translation of Our Questionnaire

Page 1
Dear Sir or Madam,

on March 1, you were finally allowed to open up again. For our dissertations in economics at the University of Bonn, we investigate how the pandemic and the lockdown in Germany affect the hairdressers and the prices for haircuts.

We kindly ask you to take 10 to 15 minutes to fill out our survey. If you have less time at your proposal, we would also be happy for partially filled out forms (all answers are optional). You can also save your progress and continue the survey later; to do so, please click on "save progress" on the bottom of the page.

The survey is anonymous. We do not ask for or save any personal data. Your answers will be treated confidentially and only used for scientific purposes.

Thank you very much for your support!

Thomas Kohler and Maximilian Weiß

Page 2

First, we would like to get to know you and your firm better.

1. What is your role in the firm?
() I am the owner.
() I am a franchisee.
() I am an employed manager.
() I am an employee.
() Other: [free text field]
() not applicable

2. Are you involved in the pricing in your firm?
() Yes, I set the prices.
() Yes, I suggest prices to my superior.
() Yes, I set the prices in accordance with my franchising contract.

() Yes, my associates and I set the prices together.
() No
() Other: [free text field]

3. How many branches does your firm have? (In case of franchises, please for the franchisee)
() no branch (mobile hairdresser)
() one branch
() two branches
() three to five branches
() more than five branches
() can't or won't say

4. How many employees does your firm have? (In case of franchises, please for the franchisee)
() none
() one to three
() three to six
() more than six
() can't or won't say
Comment: [free text field]

5. Which share of your customers are regulars?
() 0 % to 19 %
() 20 % to 39 %
() 40 % to 59 %
() 60 % to 79 %
() 80 % to 100 %
() can't or won't say

Page 3

On this page, we'll ask you some questions about the price of a man's haircut in your firm. If you do not offer this haircut, please indicate so (You will then receive questions about the price of a woman's haircut).

6. What is the price of the following man's haircut in your firm?
short back and sides, wash, cut, blow dry, 25 minutes

Please fill in the price including a possible hygiene surcharge.
Please fill in the base price if you charge other surcharges (e.g. for Mondays, late appoint-

ments, new customers, or other).

Before this lockdown (until December 16, 2020): [free text field] Euros
() can't or won't say

First week of March 2021: [free text field] Euros
() can't or won't say

[Planned] April 2021: [free text field] Euros
() can't or won't say

() I don't offer this kind of haircut (in this case, please indicate "can't or won't say" everywhere in this question, ignore the rest of the page, and click on "Continue").

7. Had you lowered your prices because of the VAT reduction in the second half-year of 2020?
() yes
() no
() can't or won't say

8. Pricing parts (begin of March 2021)
If the price you filled in (for begin of March 2021) contains a hygiene surcharge, please indicate what it is. If you charge different hygiene surcharges for different services, please indicate the hygiene surcharge for the haircut described above.
If new customers pay more than regular customers, please indicate the price difference.
If you charge a surcharge for late appointments, Monday appointments or weekend appointments, please indicate the surcharge.

hygiene surcharge: [free text field] Euros
new customer surcharge: [free text field] Euros
surcharge for late appointments: [free text field] Euros
surcharge for Monday appointments: [free text field] Euros
surcharge for weekend appointments: [free text field] Euros
() can't or won't say

9. Do you make more or less profit per customer with the haircut described above compared to before the pandemic (February 2020)?
() today less
() same
() today more

() can't or won't say

10. Do you make more or less profit per customer with the haircut described above compared to before the last lockdown (December 2020)?
() today less
() same
() today more
() can't or won't say

Page 4 [only if indicated that the reference man's haircut is not offered]

On this page, we'll ask you some questions about the price of a woman's haircut in your firm.

11. What is the price of the following woman's haircut in your firm?
Length is to the shoulders; wash, cut, brush, blow dry. Total time around 45 minutes. No dying or highlights or similar.

Please fill in the price including a possible hygiene surcharge.
Please fill in the base price if you charge other surcharges (e.g. for Mondays, late appointments, new customers, or other).

Before this lockdown (until December 16, 2020): [free text field] Euros
() can't or won't say

First week of March 2021: [free text field] Euros
() can't or won't say

[Planned] April 2021: [free text field] Euros
() can't or won't say

12. Had you lowered your prices because of the VAT reduction in the second half-year of 2020?
() yes
() no
() can't or won't say

13. Pricing parts (begin of March 2021)
If the price you filled in (for begin of March 2021) contains a hygiene surcharge, please indicate what it is.
If you charge different hygiene surcharges for different services, please indicate the hygiene

surcharge for the haircut described above.
If new customers pay more than regular customers, please indicate the price difference.
If you charge a surcharge for late appointments, Monday appointments or weekend appointments, please indicate the surcharge.

hygiene surcharge: [free text field] Euros
new customer surcharge: [free text field] Euros
surcharge for late appointments: [free text field] Euros
surcharge for Monday appointments: [free text field] Euros
surcharge for weekend appointments: [free text field] Euros
() can't or won't say

14. Do you make more or less profit per customer with the haircut described above compared to before the pandemic (February 2020)?
() today less
() same
() today more
() can't or won't say

15. Do you make more or less profit per customer with the haircut described above compared to before the last lockdown (December 2020)?
() today less
() same
() today more
() can't or won't say

Page 5 [only if the indicated price for March strictly larger than the price for December]

16. Why have you increased your prices since December?
You have indicated that at least one of your prices was larger in March 2021 than in December 2020. Which role did the following factors play in your increasing the prices?
Reduced capacity due to distancing rules
() no role
() a small role
() a big role
() does not apply
() can't or won't say

Recoup lost revenue / reduced reserves due to lockdown
() no role

() a small role
() a big role
() does not apply
() can't or won't say

Increased demand
() no role
() a small role
() a big role
() does not apply
() can't or won't say

Increased financing cost (for example because of new loans)
() no role
() a small role
() a big role
() does not apply
() can't or won't say

Adjustment to the general price level
() no role
() a small role
() a big role
() does not apply
() can't or won't say

Increased wage cost
() no role
() a small role
() a big role
() does not apply
() can't or won't say

The price increase is only temporary
() no role
() a small role
() a big role
() does not apply
() can't or won't say

Increased incidental cost
() no role
() a small role
() a big role
() does not apply
() can't or won't say

Increased hygiene cost (masks, disinfection, time)
() no role
() a small role
() a big role
() does not apply
() can't or won't say

Expectation that the customers understand the price increases
() no role
() a small role
() a big role
() does not apply
() can't or won't say

Competitors have increased their prices
() no role
() a small role
() a big role
() does not apply
() can't or won't say

End of the VAT reduction
() no role
() a small role
() a big role
() does not apply
() can't or won't say

Other important factors:
[free text field]
[free text field]
[free text field]

17. To what extent do you agree with these statements about your experiences with your customers?

The customers express understanding for my/our prices.
() totally disagree
() somewhat disagree
() undecided
() somewhat agree
() totally agree
() can't or won't say

The customers complain to me about their own financial situation.
() totally disagree
() somewhat disagree
() undecided
() somewhat agree
() totally agree
() can't or won't say

Some customers accuse me of profiteering.
() totally disagree
() somewhat disagree
() undecided
() somewhat agree
() totally agree
() can't or won't say

The customers tip more.
() totally disagree
() somewhat disagree
() undecided
() somewhat agree
() totally agree
() can't or won't say

The customers tip less.
() totally disagree
() somewhat disagree
() undecided
() somewhat agree

() totally agree
() can't or won't say

page 6 [only if the indicated price for March is not larger than the price for December]

18. Why have you not increased your prices since last December?

You have indicated that at least one of your prices is not larger in March 2021 than in December 2020.
Which role did the following factors play in your decision to not increase the price?
The prices are contracted [in the ranking table: prices contracted]
() no role
() a small role
() a big role
() does not apply
() can't or won't say

Within the firm, we could not agree on a price increase [in the ranking table: could not agree on increase]
() no role
() a small role
() a big role
() does not apply
() can't or won't say

I am not sure whether increased prices would be better for the firm [in the ranking table: unsure about increasing]
() no role
() a small role
() a big role
() does not apply
() can't or won't say

A price increase would seem larger than it actually is [in the ranking table: pricing points]
() no role
() a small role
() a big role
() does not apply
() can't or won't say

Increase the market share / gain new customers [in the ranking table: gain new customers]
() no role
() a small role
() a big role
() does not apply
() can't or won't say

The prices were already increased after the first lockdown (spring 2020) [not in the ranking table]
() no role
() a small role
() a big role
() does not apply
() can't or won't say

The customers' budgets are smaller during the pandemic [in the ranking table: customers' budgets smaller]
() no role
() a small role
() a big role
() does not apply
() can't or won't say

VAT reduction was not passed on in the second half-year of 2020 [in the ranking table: not passed on VAT reduction]
() no role
() a small role
() a big role
() does not apply
() can't or won't say

The competitors have not increased their prices [in the ranking table: competitors' prices not up]
() no role
() a small role
() a big role
() does not apply
() can't or won't say

The prices were not increased, so they don't have to be decreased again soon [in the ranking

table: avoid temporary increase]
() no role
() a small role
() a big role
() does not apply
() can't or won't say

The costs have not increased [in the ranking table: cost not increased]
() no role
() a small role
() a big role
() does not apply
() can't or won't say

Retaining regular customers [in the ranking table: retain regular customers]
() no role
() a small role
() a big role
() does not apply
() can't or won't say

Other important factors:
[free text field]
[free text field]
[free text field]

19. To what extent do you agree with these statements about your experiences with your customers?

The customers express understanding for my/our prices.
() totally disagree
() somewhat disagree
() undecided
() somewhat agree
() totally agree
() can't or won't say

The customers complain to me about their own financial situation.
() totally disagree
() somewhat disagree

() undecided
() somewhat agree
() totally agree
() can't or won't say

Some customers accuse me of profiteering.
() totally disagree
() somewhat disagree
() undecided
() somewhat agree
() totally agree
() can't or won't say

The customers tip more.
() totally disagree
() somewhat disagree
() undecided
() somewhat agree
() totally agree
() can't or won't say

The customers tip less.
() totally disagree
() somewhat disagree
() undecided
() somewhat agree
() totally agree
() can't or won't say

Page 7

On this page we ask you questions about how your company is dealing with the political measures and how you assess future developments.
20. If you received more requests for appointments for the beginning of March than you could satisfy: how did you deal with it?

Multiple answers are possible.

[ ] preferential treatment of new customers
[ ] hire more employees to offer more appointments

[ ] preferential treatment of customers that had appointments canceled in the past months
[ ] preferential treatment of regular customers
[ ] first come, first served
[ ] extend the opening hours to offer more appointments
[ ] charge a surcharge for new customers
() does not apply
() can't or won't say

21. To what extent do you agree with these statements about the mandate to wash the customers' hair?

I feel safer when I wash the customers' hair before the treatment.
() totally disagree
() somewhat disagree
() undecided
() somewhat agree
() totally agree
() can't or won't say

The mandatory hair washing is like a price increase.
() totally disagree
() somewhat disagree
() undecided
() somewhat agree
() totally agree
() can't or won't say

The customers find the mandatory hair washing acceptable.
() totally disagree
() somewhat disagree
() undecided
() somewhat agree
() totally agree
() can't or won't say

I profit from the mandatory hair washing.
() totally disagree
() somewhat disagree
() undecided
() somewhat agree

() totally agree
() can't or won't say

22. How accurate do you think the following predictions are?

We will be back to normal in one year.
() not at all
() rather not
() unclear
() rather
() very
() can't or won't say

The hygiene measures will stay for years.
() not at all
() rather not
() unclear
() rather
() very
() can't or won't say

Fear will deter customers for a long time.
() not at all
() rather not
() unclear
() rather
() very
() can't or won't say

My personal financial situation will improve (compared to today).
() not at all
() rather not
() unclear
() rather
() very
() can't or won't say

Due to (fighting) the pandemic, the customers' willingness to pay will lastingly decrease.
() not at all
() rather not

() unclear
() rather
() very
() can't or won't say

There will be another lockdown this year.
() not at all
() rather not
() unclear
() rather
() very
() can't or won't say

23. How unsure are you about your own professional future?
() not at all
() barely
() somewhat
() a lot
() can't or won't say

Page 8
On this page, we ask general questions about pricing in your firm.

24. In general, what do you pay most attention to when setting prices?
Multiple answers are possible.

[ ] Costs
[ ] The competitors' prices
[ ] The quality of my offer
[ ] Customer satisfaction
[ ] Adjustment to the general price level
[ ] Something else: [free text field]
() can't or won't say

25. To what extent do you agree with these statements about your pricing?

I am satisfied with my pricing method.
() totally disagree
() somewhat disagree
() undecided

() somewhat agree
() totally agree
() can't or won't say

My prices are optimal for the firm.
() totally disagree
() somewhat disagree
() undecided
() somewhat agree
() totally agree
() can't or won't say

Actually, my prices should be higher.
() totally disagree
() somewhat disagree
() undecided
() somewhat agree
() totally agree
() can't or won't say

The reasons for price increases are understandable for customers.
() totally disagree
() somewhat disagree
() undecided
() somewhat agree
() totally agree
() can't or won't say

Page 9

Thank you very much for participating in our study!
26. If you want to tell us anything, you can do so anonymously here (note: this answer will be saved together with the other answers, but without any personal information).
If you have a question that you would like an answer to, please feel free to email us.
[free text field]

Last page

Thank you again for participating!
Your answers have been saved, you may close the browser window now.

oeffnung_der_friseure → base 19.04.2021, 11:38

Seite 01

Startseite

Sehr geehrte Damen und Herren,

am 01. März durften Sie endlich wieder öffnen. Im Rahmen unserer Doktorarbeiten in VWL an der Universität Bonn untersuchen wir, wie sich die Pandemie und der Lockdown in Deutschland auf die Friseur/innen und die Preise für Haarschnitte auswirken.

Wir bitten Sie, sich 10 bis 15 Minuten Zeit zu nehmen, um unseren Fragebogen auszufüllen. Sollten Sie weniger Zeit zur Verfügung haben, würden wir uns auch über teilweise ausgefüllte Bögen freuen (alle Antworten sind optional). Sie können auch Ihren zwischenzeitlichen Fortschritt abspeichern und die Befragung zu einem späteren Zeitpunkt an der Stelle fortsetzen; dazu klicken Sie bitte auf "Fortschritt speichern" am unteren Rand der Seite.

Die Befragung ist anonym. Es werden keinerlei personenbezogene Daten erhoben oder gespeichert. Ihre Angaben werden vertraulich behandelt und nur für wissenschaftliche Zwecke verwendet.

Herzlichen Dank für Ihre Unterstützung!
Thomas Kohler und Maximilian Weiß

PHP-Code

```
$pageNr = 1;
replace('%ownPageNumber%',$pageNr);
option('progress',round(100*$pageNr/7));
option('progress.last','KO');
```

Seite 02

PHP-Code

```
$pageNr = 2;
replace('%ownPageNumber%',$pageNr);
option('progress',round(100*$pageNr/7));
```

Teil 1 Allgemein

Zunächst möchten wir etwas über Sie und Ihr Unternehmen erfahren.

AI03

1. Was ist Ihre Rolle in Ihrem Unternehmen?

- ○ Ich bin der/die Besitzer/in
- ○ Ich bin Franchise- oder Lizenznehmer/in
- ○ Ich bin angestelle/r Betriebsleiter/in
- ○ Ich bin Angestellte/r
- ○ Anderes:

- ○ Nicht zutreffend

AI02

2. Sind Sie an der Preissetzung in Ihrem Unternehmen beteiligt?

- ○ Ja, ich bestimme die Preise selbst
- ○ Ja, ich schlage meiner/m Vorgesetzten Preise vor
- ○ Ja, ich wähle die Preise im Rahmen meines Franchise-Vertrags
- ○ Ja, mein/e Geschäftspartner/in und ich wählen die Preise gemeinsam
- ○ Nein
- ○ Anderes:

AI04

3. Wie viele Filialen hat Ihr Unternehmen? (Bei Franchises bitte für das Franchise-nehmende Unternehmen)

- ○ keine Filiale (mobiler Friseur)
- ○ eine Filiale
- ○ zwei Filialen
- ○ drei bis fünf Filialen
- ○ mehr als fünf Filialen

- ○ Kann / Möchte ich nicht sagen

AI05

4. Wie viele Angestellte hat Ihr Unternehmen? (Bei Franchises bitte für das Franchise-nehmende Unternehmen)

- ○ keine
- ○ eine/n bis drei
- ○ drei bis sechs
- ○ mehr als sechs

- ○ Kann / Möchte ich nicht sagen

AI08

Anmerkung:

5. Welcher Anteil Ihrer Kunden sind Stammkunden?

AI01

- ○ 0 % bis 19 %
- ○ 20 % bis 39 %
- ○ 40 % bis 59 %
- ○ 60 % bis 79 %
- ○ 80 % bis 100 %

- ○ Kann / Möchte ich nicht sagen

Seite 03

PHP-Code

```
$pageNr = 3;
replace('%ownPageNumber%',$pageNr);
option('progress',round(100*$pageNr/7));
```

Teil 2 Preise Haarschnitt 1

Auf dieser Seite stellen wir Ihnen einige Fragen zum Preis eines Herren-Haarschnitts in Ihrem Unternehmen. Falls Sie diesen Haarschnitt nicht anbieten, markieren Sie dies bitte (Sie erhalten dann Fragen zum Preis eines Damen-Haarschnitts).

PL01

6. Wie viel kostet der folgende Herren-Haarschnitt in Ihrem Unternehmen?

Klassischer Fassonschnitt. Waschen, Schneiden, Föhnen. Gesamtdauer etwa 25 Minuten.

Bitte geben Sie den Preis inklusive einer eventuellen Hygienepauschale an.

Bitte geben Sie den Grundpreis an, falls Sie andere Zuschläge (z.B. montags, späte Termine, für Neukunden oder ähnliches) erheben.

Vor diesem Lockdown (bis zum 16. Dezember 2020)		Euro	☐ Kann / Möchte ich nicht sagen
Erste Märzwoche 2021		Euro	☐ Kann / Möchte ich nicht sagen
April 2021		Euro	☐ Kann / Möchte ich nicht sagen

PL14

☐ Ich biete diese Art Haarschnitt nicht an (Bitte kreuzen Sie in diesem Fall bei dieser Frage überall „Kann ich nicht sagen“ an und ignorieren Sie bitte den Rest dieser Seite und klicken auf „Weiter“.)

PL16

7. Hatten Sie aufgrund der Mehrwertsteuersenkung im zweiten Halbjahr 2020 Ihre Preise gesenkt?

○ ja	○ nein	○ Kann / Möchte ich nicht sagen

PL05

8. Preisbestandteile (Anfang März 2021)

Falls der angegebene Preis (Anfang März 2021) eine Hygienepauschale beinhaltet, geben Sie bitte an, wie hoch diese ist. Falls Sie eine unterschiedlich hohe Hygienezuschläge für unterschiedliche Dienstleistungen erheben, geben Sie bitte den Hygienezuschlag für den oben beschriebenen Haarschnitt an.

Falls Neukunden mehr zahlen als Stammkunden, geben Sie bitte den Preisunterschied an.

Falls Sie einen Zuschlag für späte Termine, für Termine am Montag oder für Termine am Wochenende erheben, geben Sie bitte die Höhe des Zuschlags an.

☐ Hygienepauschale: Euro

☐ Neukunden-Zuschlag: Euro

☐ Zuschlag für späte Termine: Euro

☐ Zuschlag für Termine am Montag: Euro

☐ Zuschlag für Termine am Wochenende: Euro

☐ Kann / Möchte ich nicht sagen

9. Machen Sie mit dem oben beschriebenen Haarschnitt pro Kunde heute mehr oder weniger Gewinn als vor der Pandemie (Februar 2020)?

heute weniger	gleich viel	heute mehr	Kann / Möchte ich nicht sagen
○	○	○	○

10. Machen Sie mit dem oben beschriebenen Haarschnitt pro Kunde heute mehr oder weniger Gewinn als vor dem letzten Lockdown (Dezember 2020)? PL10

heute weniger	gleich viel	heute mehr	Kann / Möchte ich nicht sagen
○	○	○	○

Seite 04

PHP-Code

```
if (value('PL14_01')==1){
goToPage('PH');
}
$pageNr = 3;
replace('%ownPageNumber%',$pageNr);
option('progress',round(100*$pageNr/7));
```

Teil 2 Preise Haarschnitt 2

Auf dieser Seite stellen wir Ihnen einige Fragen zum Preis eines Damen-Haarschnitts in Ihrem Unternehmen.

PL02

11. Wie viel kostet der folgende Damen-Haarschnitt in Ihrem Unternehmen?

Haarlänge: etwa schulterlang

Waschen, Schneiden, Kämmen, Föhnen. Gesamtdauer etwa 45 Minuten.

Keine Farbe, Strähnchen oder ähnliches.

Bitte geben Sie den Preis inklusive einer eventuellen Hygienepauschale an.

Bitte geben Sie den Grundpreis an, falls Sie andere Zuschläge (z.B. montags, späte Termine, für Neukunden oder ähnliches) erheben.

Vor diesem Lockdown (bis zum 16. Dezember 2020)		Euro	☐ Kann / Möchte ich nicht sagen
Erste Märzwoche 2021		Euro	☐ Kann / Möchte ich nicht sagen
April 2021		Euro	☐ Kann / Möchte ich nicht sagen

PL17

12. Hatten Sie aufgrund der Mehrwertsteuersenkung im zweiten Halbjahr 2020 Ihre Preise gesenkt?

○ ja	○ nein	○ Kann / Möchte ich nicht sagen

PL13

13. Preisbestandteile (Anfang März 2021)

Falls der angegebene Preis (Anfang März 2021) eine Hygienepauschale beinhaltet, geben Sie bitte an, wie hoch diese ist. Falls Sie eine unterschiedlich hohe Hygienezuschläge für unterschiedliche Dienstleistungen erheben, geben Sie bitte den Hygienezuschlag für für den oben beschriebenen Haarschnitt an.

Falls Neukunden mehr zahlen als Stammkunden, geben Sie bitte den Preisunterschied an.

Falls Sie einen Zuschlag für späte Termine, für Termine am Montag oder für Termine am Wochenende erheben, geben Sie bitte die Höhe des Zuschlags an.

☐ Hygienepauschale: Euro

☐ Neukunden-Zuschlag: Euro

☐ Zuschlag für späte Termine: Euro

☐ Zuschlag für Termine am Montag: Euro

☐ Zuschlag für Termine am Wochenende: Euro

☐ Kann / Möchte ich nicht sagen

14. Machen Sie mit dem oben beschriebenen Haarschnitt pro Kunde heute mehr oder weniger Gewinn als vor der Pandemie (Februar 2020)?

heute weniger	gleich viel	heute mehr	Kann / Möchte ich nicht sagen
○	○	○	○

15. Machen Sie mit dem oben beschriebenen Haarschnitt pro Kunde heute mehr oder weniger Gewinn als vor dem letzten Lockdown (Dezember 2020)?

PL12

heute weniger	gleich viel	heute mehr	Kann / Möchte ich nicht sagen
○	○	○	○

Seite 05
PH

PHP-Code

```
if (
(
(value('PL14_01') == 1) and (value('PL01_02') <= value('PL01_01'))
)
or
(
(value('PL14_01') == 2) and (value('PL02_02') <= value('PL02_01'))
)
){
goToPage('PG');
}
$pageNr = 4;
replace('%ownPageNumber%',$pageNr);
option('progress',round(100*$pageNr/7));
```

PL03

16. Weshalb haben sich Ihre Preise seit letztem Dezember erhöht?

Sie haben angegeben, dass mindestens einer Ihrer Preise im März 2021 höher ist als er im Dezember 2020 war. Welche Rolle haben die folgenden Faktoren bei der Preiserhöhung gespielt?

	Keine Rolle	Eine kleine Rolle	Eine große Rolle	Trifft nicht zu	Kann / Möchte ich nicht sagen
verringerte Kapazität durch Abstandsregelungen	○	○	○	○	○
Ausgleich des entgangenen Umsatzes / des Rücklagenabbaus durch den Lockdown	○	○	○	○	○
höhere Nachfrage	○	○	○	○	○
gestiegene Finanzierungskosten (zum Beispiel wegen Kreditaufnahme)	○	○	○	○	○
Anpassung an das allgemeine Preisniveau	○	○	○	○	○
gestiegene Lohnkosten	○	○	○	○	○
Die Preiserhöhung ist nur kurzfristig.	○	○	○	○	○
gestiegene Nebenkosten	○	○	○	○	○
gestiegener Hygieneaufwand (Masken, Desinfektionsmittel und Zeit)	○	○	○	○	○
Erwartung, dass Kunden für Preiserhöhung Verständnis haben	○	○	○	○	○
gestiegene Preise der Konkurrenz	○	○	○	○	○
Ende der Mehrwertsteuersenkung	○	○	○	○	○

PL07

Sonstige wichtige Faktoren:

17. Inwiefern stimmen Sie diesen Aussagen über Ihre Erfahrungen mit Ihren Kunden zu? PL15

	stimme gar nicht zu	stimme eher nicht zu	unent-schieden	stimme eher zu	stimme voll zu	Kann / Möchte ich nicht sagen
Die Kunden äußern Verständnis für meine/unsere Preise.	○	○	○	○	○	○
Die Kunden beklagen sich aufgrund ihrer eigenen finanziellen Situation über die Preise.	○	○	○	○	○	○
Einzelne Kunden haben mir vorgeworfen von der Krise profitieren zu wollen.	○	○	○	○	○	○
Die Kunden geben mehr Trinkgeld.	○	○	○	○	○	○
Die Kunden geben weniger Trinkgeld.	○	○	○	○	○	○

Seite 06
PG

PHP-Code

```
if ((value('PL01_02') > value('PL01_01')) or (value('PL02_02') > value('PL02_01'))) {
goToPage('RA');
}
$pageNr = 4;
replace('%ownPageNumber%',$pageNr);
option('progress',round(100*$pageNr/7));
```

PL04

18. Weshalb haben sich Ihre Preise seit letztem Dezember nicht erhöht?

Sie haben angegeben, dass mindestens einer Ihrer Preise im März 2021 nicht höher ist als er im Dezember 2020 war. Welche Rolle haben die folgenden Faktoren bei der Entscheidung, den Preis nicht zu erhöhen, für Sie gespielt?

	keine Rolle	eine kleine Rolle	eine große Rolle	Trifft nicht zu	Kann / Möchte ich nicht sagen
Die Preise sind vertraglich festgelegt.	○	○	○	○	○
Innerhalb des Unternehmens konnten wir uns nicht auf Preissteigerungen einigen.	○	○	○	○	○
Ich weiß nicht, ob höhere Preise besser für das Unternehmen wären.	○	○	○	○	○
Eine Preiserhöhung würde größer scheinen als sie wirklich ist.	○	○	○	○	○
Erhöhung des Marktanteils / neue Kunden gewinnen	○	○	○	○	○
Die Preise wurden bereits nach dem 1. Lockdown (Frühjahr 2020) erhöht.	○	○	○	○	○
Zahlungskraft der Kunden ist in der Pandemie geringer	○	○	○	○	○
Mehrwertsteuersenkung im zweiten Halbjahr 2020 wurde nicht weitergegeben	○	○	○	○	○
Die Konkurrenz hat ihre Preise nicht erhöht.	○	○	○	○	○
Die Preise wurden nicht erhöht, um sie nicht in absehbarer Zeit wieder senken zu müssen.	○	○	○	○	○
Die Kosten sind nicht gestiegen.	○	○	○	○	○
Erhalt der Stammkunden	○	○	○	○	○

PL08

Sonstige wichtige Faktoren:

19. Inwiefern stimmen Sie diesen Aussagen über Ihre Erfahrungen mit Ihren Kunden zu? PL15

	stimme gar nicht zu	stimme eher nicht zu	unent-schieden	stimme eher zu	stimme voll zu	Kann / Möchte ich nicht sagen
Die Kunden äußern Verständnis für meine/unsere Preise.	○	○	○	○	○	○
Die Kunden beklagen sich aufgrund ihrer eigenen finanziellen Situation über die Preise.	○	○	○	○	○	○
Einzelne Kunden haben mir vorgeworfen von der Krise profitieren zu wollen.	○	○	○	○	○	○
Die Kunden geben mehr Trinkgeld.	○	○	○	○	○	○
Die Kunden geben weniger Trinkgeld.	○	○	○	○	○	○

Seite 07
RA

PHP-Code

```
$pageNr = 5;
replace('%ownPageNumber%',$pageNr);
option('progress',round(100*$pageNr/7));
```

Teil 3 Zustand nach Lockdown

Auf dieser Seite stellen wir Ihnen Fragen dazu, wie Ihr Unternehmen mit den politischen Maßnahmen umgeht, und wie Sie die zukünftige Entwicklung einschätzen.

LO04

20. Falls Sie für Anfang März mehr Terminanfragen erhalten haben, als Sie Termine zu vergeben hatten: wie sind Sie damit umgegangen?

Mehrfachantworten sind möglich

- ☐ Bevorzugung von Neukunden
- ☐ Anstellung von Mitarbeitern, um mehr Termine anbieten zu können
- ☐ Bevorzugung von Kunden, deren Termine in den letzten Monaten abgesagt werden mussten
- ☐ Bevorzugung von Stammkunden
- ☐ Wer zuerst angefragt hat, hat Termine bekommen
- ☐ Ausweitung der Öffnungszeiten, um mehr Termine anbieten zu können
- ☐ Erhebung eines Zuschlags für Neukunden

- ☐ Trifft nicht zu
- ☐ Kann / Möchte ich nicht sagen

LO01

21. Inwiefern stimmen Sie diesen Aussagen über die Pflicht zum Haarewaschen zu?

	Stimme gar nicht zu	Stimme eher nicht zu	Unent-schieden	Stimme eher zu	Stimme voll zu	Kann / Möchte ich nicht sagen
Ich fühle mich sicherer, wenn die Haare der Kunden vor der Behandlung gewaschen werden.	○	○	○	○	○	○
Die Pflicht zum Haarewaschen ist wie eine Preiserhöhung.	○	○	○	○	○	○
Die Kunden finden die Pflicht zum Haarewaschen akzeptabel.	○	○	○	○	○	○
Ich profitiere finanziell von der Pflicht zum Haarewaschen.	○	○	○	○	○	○

LO07

22. Für wie zutreffend halten Sie die folgenden Vorhersagen?

	gar nicht	eher nicht	unklar	eher ja	sehr	Kann / Möchte ich nicht sagen
In einem Jahr werden wir wieder den Zustand von vor der Pandemie haben.	○	○	○	○	○	○
Infektionsschutzmaßnahmen werden noch für Jahre vorgeschrieben bleiben.	○	○	○	○	○	○
Die Angst vor dem Virus wird manche Menschen noch lange Zeit von einem Friseurbesuch abhalten.	○	○	○	○	○	○
Meine persönliche finanzielle Situation wird sich längerfristig verbessern (verglichen zu heute).	○	○	○	○	○	○
Infolge der Pandemie(bekämpfung) wird die Zahlungsbereitschaft meiner/unserer Kunden nachhaltig sinken.	○	○	○	○	○	○
Es wird dieses Jahr einen weiteren Lockdown geben, in dem Friseurläden wieder schließen müssen.	○	○	○	○	○	○

23. Wie unsicher sind Sie sich über Ihre berufliche Zukunft?

LO08

gar nicht	kaum	etwas	sehr	Kann / Möchte ich nicht sagen
○	○	○	○	○

Seite 08

PHP-Code

```
$pageNr = 6;
replace('%ownPageNumber%',$pageNr);
option('progress',round(100*$pageNr/7));
```

Teil 4 Preissetzung allgemein

Auf dieser Seite stellen wir Ihnen allgemeine Fragen zur Preissetzung in Ihrem Unternehmen.

PA01

24. Im Allgemeinen, worauf achten Sie am meisten bei der Preissetzung?

Mehrfachantworten sind möglich

- ☐ Kosten
- ☐ Preise der Konkurrenz
- ☐ Qualität meines Angebots
- ☐ Kundenzufriedenheit
- ☐ Anpassung an das allgemeine Preislevel
- ☐ Anderes:

- ☐ Kann / Möchte ich nicht sagen

PA02

25. Inwiefern stimmen Sie diesen Aussagen über Ihre Preissetzung zu?

	stimme gar nicht zu	stimme eher nicht zu	unent-schieden	stimme eher zu	stimme voll zu	Kann / Möchte ich nicht sagen
Ich bin zufrieden mit der Art wie ich/wir Preise setze/n.	○	○	○	○	○	○
Die Preise sind optimal für das Unternehmen gewählt.	○	○	○	○	○	○
Eigentlich sollten die Preise höher sein.	○	○	○	○	○	○
Die Gründe für Preiserhöhungen sind für die Kunden nachvollziehbar.	○	○	○	○	○	○

Seite 09
KO

PHP-Code

```
$pageNr = 7;
replace('%ownPageNumber%',$pageNr);
option('progress',round(100*$pageNr/7));
```

Danke

Vielen Dank für Ihre Teilnahme an unserer Studie!

S001

26. Wenn Sie uns etwas mitteilen möchten, können Sie dies hier anonym tun

Anmerkung: Diese Antwort wird zusammen mit Ihren anderen Antworten, aber ohne personenbezogene Informationen gespeichert.

Sollten Sie eine Frage haben, auf die Sie eine Antwort wünschen, können Sie uns gerne eine E-Mail schreiben.

Letzte Seite

Nochmals vielen Dank für Ihre Teilnahme!

Ihre Antworten wurden gespeichert, Sie können das Browser-Fenster nun schließen.

Thomas Kohler und Maximilian Weiß, Bonn Graduate School of Economics

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C Regression Tables

C.1 Retaining Regulars Applies Less Often

Stylized Fact 1. *Among the non-increasers, the higher the understanding of a firm's customers of its prices, the less important for price stickiness is the motive of retaining its regular customers.*

	(1)	(2)	(3)
Dummy for retain regulars applies			
Cust. understand prices	-7.956**	-20.82*	-20.61*
	(4.035)	(12.43)	(10.77)
Employees (linear part)		-7.377***	-9.426***
		(0.822)	(0.993)
Dummy for many employees=1		-32.12***	-40.27***
		(3.128)	(4.482)
Satisfaction with pricing		2.814**	
		(1.309)	
Hairwashing		-0.934	
		(1.054)	
Pessimism		-4.867	
		(3.837)	
Share of regular customers		-0.431	
		(0.831)	
Rel. price December			-3.753***
			(1.432)
Constant	8.848**	55.51***	64.37***
	(3.575)	(17.74)	(12.30)
Observations	81	74	52
Pseudo R2	0.134	0.585	0.543

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 9: Logit regression. The dependent variable is whether the respondent marked the hypothesis "Retain regular customers" as applicable or not.

C.2 More Likely to Increase Prices

Stylized Fact 2. *Firms with high understanding customers are more likely to increase their nominal prices.*

	(1)	(2)	(3)
Price increased during the lockdown?			
Cust. understand prices	2.593***	3.553***	3.566**
	(0.710)	(1.205)	(1.562)
Employees (linear part)		0.0790	0.0953
		(0.113)	(0.139)
Dummy for many employees=1		0.443	0.207
		(0.446)	(0.590)
More than one salon=1		-0.560	-0.400
		(0.492)	(0.617)
Satisfaction with pricing		-1.504*	-1.589*
		(0.813)	(0.959)
Hairwashing		0.201	0.0528
		(0.537)	(0.671)
Pessimism		-0.101	-0.739
		(1.557)	(2.046)
Share of regular customers		0.0280	0.150
		(0.234)	(0.277)
Rel. price December			-1.411*
			(0.765)
Constant	-1.485**	-1.697	-0.189
	(0.580)	(1.411)	(1.934)
Observations	237	207	137
Pseudo R2	0.0343	0.0521	0.0836

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 10: Logit regression. The dependent variable is a dummy indicating whether the respondent increased the price during the lockdown or not.

	(1)
Employees (linear part)	0.0212
	(0.0308)
Dummy for many employees=1	0.0875
	(0.120)
More than one salon=1	-0.126
	(0.161)
High understanding customers=1	0.237***
	(0.0888)
Satisfaction with pricing	-0.201
	(0.173)
Hairwashing	0.0397
	(0.146)
Pessimism	-0.205
	(0.437)
Rel. price December	-0.312*
	(0.164)
Share of regular customers	0.0590
	(0.0661)
N	138

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 11: Logit regression with high understanding customers-indicator. Marginal effects at means.

C.3 Higher Nominal and Relative Price Increase

Stylized Fact 3. *Firms with high understanding customers increase their nominal and relative prices by more.*

(a) Conditional, nominal

(b) Conditional, relative

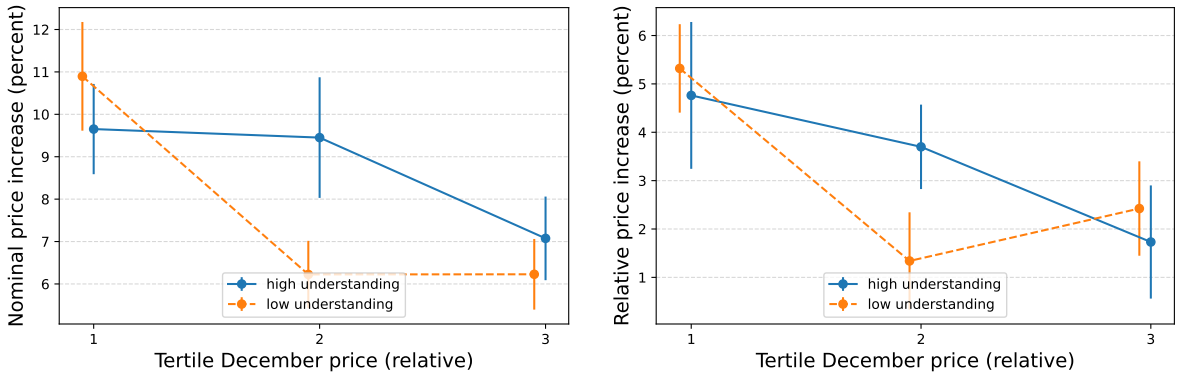

Figure C.1: Nominal and relative price increases conditional on price change, over the relative price distribution and by understanding-type. The increase is from December 2020 to March 2021. For the nominal price increase (left panel), the difference between the two understanding-types is only statistically significant for the second tertile (two-sample t-test, standard errors clustered at the district level; p=6%, $N_L = 9$ (9 cluster), $N_H = 20$ (12 cluster)). For the relative price increase (right panel), the difference between the two understanding-types is only statistically significant for the second tertile (two-sample t-test, standard errors clustered at the district level; p=9%, $N_L = 9$ (9 cluster), $N_H = 20$ (12 cluster)). The whiskers denote 68% confidence intervals.

	(1)	(2)	(3)
Cust. understand prices	6.757***	8.909**	9.748**
	(2.074)	(3.450)	(4.198)
Employees (linear part)		-0.183	-0.290
		(0.328)	(0.402)
Dummy for many employees=1		0.393	-1.307
		(1.475)	(1.439)
More than one salon=1		-1.964	-1.102
		(1.384)	(1.610)
Satisfaction with pricing		-3.502*	-4.373**
		(1.931)	(1.973)
Hairwashing		0.532	-0.336
		(1.459)	(1.267)
Pessimism		2.098	3.504
		(4.642)	(5.564)
Share of regular customers		-0.491	-0.430
		(0.630)	(0.704)
Rel. price December			-4.460***
			(1.259)
Constant	0.179	1.978	6.262
	(1.628)	(4.628)	(6.166)
Observations	237	207	137
R2	0.0361	0.0576	0.146

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 12: OLS regression. The dependent variable is the percent increase of the firm's nominal price from December 2020 to March 2021.

	(1)	(2)	(3)
Cust. understand prices	6.946***	8.862**	8.917**
	(2.049)	(3.533)	(3.558)
Employees (linear part)		0.00928	0.198
		(0.312)	(0.304)
Dummy for many employees=1		-0.396	0.500
		(1.004)	(1.167)
More than one salon=1		-2.272	-1.891
		(2.227)	(1.805)
Satisfaction with pricing		-4.442*	-4.784**
		(2.256)	(2.050)
Hairwashing		0.517	0.740
		(1.665)	(1.729)
Pessimism		-1.865	-1.582
		(3.649)	(3.505)
Share of regular customers		-0.463	-0.337
		(0.720)	(0.729)
Rel. price December			-6.039***
			(1.225)
Constant	-4.888**	-0.473	4.429
	(1.759)	(4.879)	(5.591)
Observations	157	137	137
R2	0.0523	0.0927	0.169

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 13: OLS regression. The dependent variable is the percent increase of the firm's relative price from December 2020 to March 2021. The relative price is defined as the nominal price divided by the district's median price.

	(1)	(2)	(3)
High understanding customers=1	1.997***	2.469**	2.714**
	(0.703)	(0.971)	(1.159)
Employees (linear part)		-0.149	-0.293
		(0.320)	(0.387)
Dummy for many employees=1		0.707	-0.849
		(1.454)	(1.417)
More than one salon=1		-1.982	-1.383
		(1.382)	(1.560)
Satisfaction with pricing		-1.786	-2.515
		(1.713)	(1.514)
Hairwashing		0.786	0.00207
		(1.426)	(1.227)
Pessimism		1.692	2.814
		(4.660)	(5.640)
Share of regular customers		-0.263	-0.156
		(0.640)	(0.785)
Rel. price December			-4.512***
			(1.317)
Constant	4.325***	5.485	10.17
	(0.557)	(4.165)	(6.090)
Observations	281	209	138
R2	0.0234	0.0438	0.122

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 14: OLS regression. The dependent variable is the percent increase of the firm's nominal price from December 2020 to March 2021.

	(1)	(2)	(3)
High understanding customers=1	1.671**	1.897**	1.911*
	(0.620)	(0.896)	(0.935)
Employees (linear part)		-0.0303	0.157
		(0.307)	(0.302)
Dummy for many employees=1		-0.154	0.738
		(0.955)	(1.123)
More than one salon=1		-2.550	-2.175
		(2.244)	(1.892)
Satisfaction with pricing		-2.325	-2.673
		(1.908)	(1.703)
Hairwashing		0.796	1.020
		(1.637)	(1.725)
Pessimism		-2.872	-2.545
		(3.867)	(3.640)
Share of regular customers		-0.221	-0.100
		(0.759)	(0.743)
Rel. price December			-6.090***
			(1.337)
Constant	-0.477	3.480	8.482
	(0.748)	(5.068)	(5.664)
Observations	186	138	138
R2	0.0204	0.0573	0.134

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 15: OLS regression. The dependent variable is the percent increase of the firm's relative price from December 2020 to March 2021. The relative price is defined as the nominal price divided by the district's median price.

C.4 Rather Restored Profit Margin

Stylized Fact 4. *Firms with high understanding customers are better able to increase their profit margins.*

	(1) mean	(2) mean	(3) t
Profit margin before pandemic	-0.14	-0.04	(-1.04)
Profit margin before lockdown	-0.20	-0.09	(-1.33)
Observations	84	173	257

Table 16: Means of the answers to the question about the profit margin compared to before the pandemic and before the lockdown for firms with low understanding (first column) and high understanding (second column) customers. The third column is the t statistic of a two-sample t-test for the null hypothesis that the means are equal. The null can be rejected for the one-sided alternative that high understanding customers have a higher mean at the 10%-level for the profit margin before lockdown (second row), while it cannot be rejected for the profit margin before the pandemic (first row, at p=15%).

C.5 More Satisfied with Own Pricing

Stylized Fact 5. *Firms with high understanding customers are more satisfied with their own pricing.*

	(1)	(2)	(3)
Cust. understand prices	0.531***	0.512***	0.503***
	(0.0549)	(0.0624)	(0.0753)
Employees (linear part)		-0.00425	0.00255
		(0.00956)	(0.0134)
Dummy for many employees=1		0.0116	0.0464
		(0.0336)	(0.0451)
More than one salon=1		0.0381	0.0599
		(0.0352)	(0.0418)
Hairwashing		0.0518	0.109**
		(0.0351)	(0.0425)
Pessimism		-0.0939	-0.0818
		(0.0821)	(0.119)
Share of regular customers		-0.0194	-0.00533
		(0.0250)	(0.0343)
Rel. price December			-0.0286
			(0.0407)
Constant	0.193***	0.329**	0.252
	(0.0467)	(0.127)	(0.173)
Observations	224	207	137
R2	0.228	0.239	0.247

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 17: OLS regression. The dependent variable is the summary variable of the respondent's satisfaction with the own pricing method.

C.6 Are Less Pessimistic

Stylized Fact 6. *Owners of firms with high understanding customers are less pessimistic.*

	(1)	(2)	(3)
Cust. understand prices	-0.165***	-0.106*	-0.0832
	(0.0439)	(0.0624)	(0.0844)
Employees (linear part)		-0.00674	-0.00381
		(0.00605)	(0.00696)
Dummy for many employees=1		-0.0321	-0.0270
		(0.0233)	(0.0337)
More than one salon=1		0.0435	0.0564
		(0.0267)	(0.0454)
Satisfaction with pricing		-0.0498	-0.0365
		(0.0464)	(0.0568)
Hairwashing		0.0116	0.00289
		(0.0283)	(0.0385)
Share of regular customers		-0.0285**	-0.0270
		(0.0138)	(0.0190)
Rel. price December			0.0106
			(0.0331)
Constant	0.710***	0.836***	0.796***
	(0.0338)	(0.0712)	(0.102)
Observations	228	207	137
R2	0.0481	0.0639	0.0598

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 18: OLS regression. The dependent variable is the summary variable of the respondent's pessimism concerning the firm's and the owner's professional future.

C.7 Are Smaller

Stylized Fact 7. *Firms with less employees have more understanding customers.*

	(1)	(2)	(3)
High understanding customers			
Employees (linear part)	-0.216**	-0.296**	-0.370***
	(0.0944)	(0.116)	(0.134)
Dummy for many employees=1	-0.803*	-1.478***	-1.752***
	(0.417)	(0.526)	(0.652)
More than one salon=1	-0.281	0.0958	-0.271
	(0.533)	(0.682)	(1.144)
Pessimism		-2.734**	-2.180
		(1.254)	(1.613)
Satisfaction with pricing		3.996***	3.280***
		(1.033)	(1.125)
Hairwashing		-0.614	-0.367
		(0.490)	(0.593)
Share of regular customers		0.0196	-0.206
		(0.302)	(0.376)
Rel. price December			0.0117
			(0.531)
Constant	1.441***	0.977	1.999
	(0.347)	(2.198)	(2.648)
Observations	276	209	138
Pseudo R2	0.0167	0.132	0.120

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 19: Logit regression. The dependent variable is high understanding customers indicator variable.

	(1)
Pessimism	-0.521
	(0.390)
Employees (linear part)	-0.0884***
	(0.0317)
Dummy for many employees=1	-0.412***
	(0.135)
More than one salon=1	-0.0662
	(0.283)
Satisfaction with pricing	0.784***
	(0.260)
Hairwashing	-0.0878
	(0.142)
Rel. price December	0.00280
	(0.127)
Share of regular customers	-0.0492
	(0.0905)
N	138

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 20: Marginal effects at means.

C.8 Large Firms and Occasional Customers

	(1)	(2)	(3)
Low share of regular customers			
Employees (linear part)	0.199**	0.247*	0.290
	(0.0934)	(0.133)	(0.195)
Dummy for many employees=1	1.646***	1.662***	1.879***
	(0.376)	(0.488)	(0.660)
More than one salon=1		0.0927	1.501**
		(0.417)	(0.683)
Cust. understand prices		-0.929	-0.109
		(1.121)	(1.564)
Satisfaction with pricing		0.958	0.0788
		(1.029)	(1.226)
Hairwashing		0.0143	0.119
		(0.415)	(0.507)
Pessimism		2.827**	2.917
		(1.325)	(2.015)
Rel. price December			-0.844
			(0.626)
Constant	-1.278***	-2.997**	-2.701
	(0.317)	(1.243)	(1.897)
Observations	280	207	137
Pseudo R2	0.0481	0.0740	0.120

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 21: Logit regression. The dependent variable is an indicator variable that equals 1 if less than 80% of the firm's customers are regular customers, and 0 otherwise.

	(1)
Employees (linear part)	0.0653
	(0.0429)
Dummy for many employees=1	0.435***
	(0.136)
More than one salon=1	0.358**
	(0.149)
Cust. understand prices	-0.0246
	(0.353)
Satisfaction with pricing	0.0178
	(0.277)
Hairwashing	0.0267
	(0.115)
Pessimism	0.658
	(0.455)
Rel. price December	-0.190
	(0.143)
N	137

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 22: Marginal effects at means.

	(1)	(2)	(3)
Low share of regular customers=1	0.550***	0.560***	0.605**
	(0.151)	(0.157)	(0.225)
Employees (linear part)		-0.0281	-0.0729
		(0.0572)	(0.0692)
Dummy for many employees=1		0.398	0.325
		(0.381)	(0.530)
More than one salon=1		-0.338	-0.739
		(0.442)	(0.462)
Cust. understand prices		-0.929	-0.828
		(0.645)	(1.091)
Satisfaction with pricing		0.0371	-0.175
		(0.478)	(0.757)
Hairwashing		-0.250	-0.481
		(0.252)	(0.341)
Pessimism		0.530	1.714*
		(0.808)	(0.981)
Rel. price December			-0.0999
			(0.201)
Constant	0.255***	0.760	0.493
	(0.0806)	(0.836)	(1.108)
Observations	83	67	43
Pseudo R2			

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 23: OLS regression. The dependent variable is the grade to the hypothesis "Price not increased: gain new customers". We allocate the score 0 if the respondent answered "Does not apply".

	(1)	(2)
Number of employees		
Second rel. price tertile	-0.0683	0.343
	(0.335)	(0.405)
Third rel. price tertile	0.872***	1.132***
	(0.336)	(0.385)
More than one salon=1		3.548***
		(0.631)
Cust. understand prices		-1.506
		(1.029)
Satisfaction with pricing		0.938
		(0.783)
Hairwashing		-0.507
		(0.522)
Pessimism		-1.292
		(1.483)
Low share of regular customers=1		0.968***
		(0.355)
/		
cut1	-2.310***	-3.625**
	(0.374)	(1.696)
cut2	0.160	-0.837
	(0.265)	(1.618)
cut3	1.521***	0.808
	(0.294)	(1.617)
Observations	186	137
Pseudo R2	0.0220	0.130

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 24: Ordered logistic regression. The dependent variable is an ordered variable for the number of employees, with the values 1:no employees, 2:one to three employees, 3:four to six employees, 4:more than six employees.

D Solving the model

Figure D.1 shows the cutoffs on the distribution of idiosyncratic costs at which firms with high baseline costs and low product quality change their optimal pricing strategy in the uncertainty period $t = 1$. We choose an equilibrium such that firms with high understanding customers ($u = 1$) with idiosyncratic costs $\zeta_i < \overline{\zeta}^1$ can charge the monopoly price, as it allows their customers to learn the new industry-wide marginal costs (by proposition 5.1), which lowers their search competition. At the threshold $\overline{\zeta}^1$, the firms' costs exceed their product's expected quality, so that they exit the market.

The situation is more complex for firms with high baseline costs and low product quality whose regular customer is of the low information type ($u = 0$). Charging the monopoly price does not guarantee that customers learn the true industry-wide costs, since customers cannot observe the idiosyncratic costs of the firm. However, customers know the upper bound of the distribution of idiosyncratic costs, and therefore will learn of the industry-wide cost increase if a firm has a large enough idiosyncratic cost and charges its monopoly price (see corollary 5.1). As a result, whether firms are search-restricted or not is related in a *non-monotonic* way to their idiosyncratic costs. Firms whose idiosyncratic marginal cost component is below $\underline{\zeta}^*$ offer, by charging their monopoly price, a higher expected surplus to their customer than their search competition, even though customers do not understand that industry-wide costs increased. Firms whose costs lie between $\underline{\zeta}^*$ and $\overline{\zeta}^E$ will not induce their customer to learn of a higher industry-wide cost, since if they set their highest price (the monopoly price), their customer would leave (in terms of corollary 5.1, the γ^0 is not high enough). In that region, firms either lower their price below their monopoly price in order to compete with the customer's outside option (costs below $\overline{\zeta}^*$) or exit the market (costs above $\overline{\zeta}^*$), which happens when the expected profits at the search-restricted price are at most zero (see equation (8)). With costs above $\overline{\zeta}^E$, firms can set their monopoly price, as their customer learns enough about the industry-wide cost increase to estimate

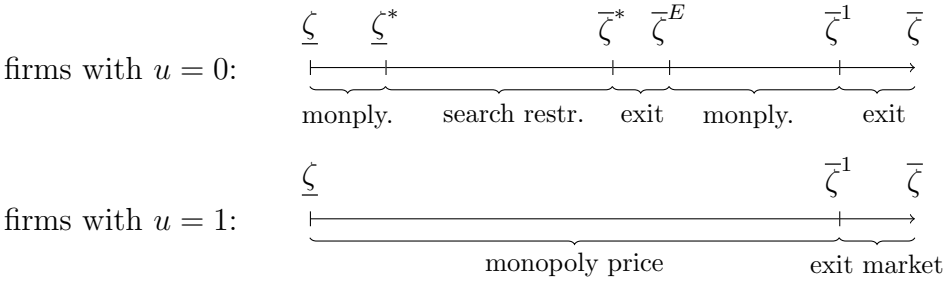

Figure D.1: Firm pricing decisions during the uncertainty period by customer information type u and idiosyncratic cost component ζ_i.

that searching would yield a lower expected surplus than staying at the firm.[33] Firms with the highest idiosyncratic costs, $\zeta_i > \overline{\zeta}^1$, exit the market, for the same reason as firms with high understanding customers.

D.1 Thresholds for different information levels

In the uncertainty period $t = 1$, we have to solve an equilibrium for the three different information levels of customers. We are only concerned with customers of high cost, low quality firms, since for all other firms, the search competition never binds. While customers of the information *type* $u = 1$ only have information level $\gamma^1 = 1$ in the equilibrium we consider, customers of the information type $u = 0$ can have the information levels $\gamma^0 \in \{0\} \vee [\underline{E}, \overline{E}]$, where $\underline{E}, \overline{E} \in (0, 1)$ are the information levels that obtain at idiosyncratic costs $\overline{\zeta}^E$ and $\overline{\zeta}^1$, respectively.

We denote the thresholds of the *true* equilibrium, i.e. the one implied by the correct level of industry-wide costs in period $t = 1$, $\underline{c}'$, as $\underline{\zeta}^*, \overline{\zeta}^*, \overline{\zeta}^E$, and $\overline{\zeta}^1$. Naturally, this is the equilibrium that is expected by customers with information level $\gamma^1 = 1$. For the equilibrium that is expected by customers who do not learn, $\gamma^0 = 0$, we denote the respective thresholds as $\underline{\zeta}^{*,0}, \overline{\zeta}^{*,0}, \overline{\zeta}^{E,0}$, and $\overline{\zeta}^{1,0}$, while for the one expected by customers who learn up to the level $\gamma^0 = \underline{E}$, we write $\underline{\zeta}^{*,E}, \overline{\zeta}^{*,E}, \overline{\zeta}^{E,E}$, and $\overline{\zeta}^{1,E}$.

We calibrate the model such that in period $t = 0$, there is no firm who produces at a lower quality than its marginal costs, i.e. $\overline{c} + \overline{\zeta} < \underline{q}$. Therefore, since customers with information level $\gamma^0 = 0$ assume that industry-wide costs did not change, $\overline{\zeta}^{1,0} = \overline{\zeta}$. Also, since they already believe that costs did not change, they do not think that any firm could charge a monopoly price that would indicate higher industry-wide costs, i.e. $\overline{\zeta}^{E,0} = \overline{\zeta}$.

D.2 Derivation of zero profit threshold

It is to show that

$$V_{it}^* = \left(1 + \sqrt{1/(1 + \mathcal{D}_t)}\right)^2 \frac{F_{it}}{2\mathcal{D}_t}.$$

Proof: V_{it}^* is the expected surplus the firm offers at which expected profits are zero. Let p_{it}^* denote the according price the firm sets. We assume that $p_{it}^* < q_{it}$. Then, the expected revenue at that price, given that the firm can hold its regular customer, is

$$(1 + \mathcal{D}_t)(1 - p_{it}^*/q_{it})p_{it}^*$$

We now subtract the expected marginal costs and the fixed costs and set the difference to

[33] We make use of the result that, for unproductive firms who offer a relatively low surplus, learning of an increase in industry-wide costs reduces the expected value from searching by more than it reduces the expected value of staying at the unproductive firm (see footnote 22). Hence, if charging the monopoly price at idiosyncratic costs $\overline{\zeta}^E$ is favourable to the firm, it will be favourable at all higher idiosyncratic costs, as the level of industry-wide costs learnt by the firm's customer increases in its charged price.

zero, where we can rewrite the first line as in equation 6:

$$(1+\mathcal{D}_t)(1-p^*_{it}/q_{it})(p^*_{it}-C_{it})-F_{it}=0 \tag{13}$$

$$\Leftrightarrow -\left(p^*_{it}-(C_{it}+q_{it})/2\right)^2=F_{it}q_{it}/(1+\mathcal{D}_t)-\left((q_{it}-C_{it})/2\right)^2 \tag{14}$$

Substituting $F_{it}=\frac{\mathcal{D}_t}{q_{it}}\left(\frac{q_{it}-C_{it}}{2}\right)^2$ yields

$$\left(p^*_{it}-(C_{it}+q_{it})/2\right)^2=\left((q_{it}-C_{it})/2\right)^2\left(1-\mathcal{D}_t/(1+\mathcal{D}_t)\right) \tag{15}$$

which has the solution

$$p^*_{it}=(C_{it}+q_{it})/2+\sqrt{1/(1+\mathcal{D}_t)}(C_{it}-q_{it})/2$$

Inserting this into formula 2 yields

$$V^*_{it}=(q_{it}-p^*_{it})^2/(2q_{it}) \tag{16}$$

$$=\frac{\left((q_{it}-C_{it})/2-\sqrt{1/(1+\mathcal{D}_t)}(C_{it}-q_{it})/2\right)^2}{2q_{it}} \tag{17}$$

$$=\frac{\left((q_{it}-C_{it})/2\right)^2}{q_{it}}\left(1+\sqrt{1/(1+\mathcal{D}_t)}\right)^2/2 \tag{18}$$

$$=\left(1+\sqrt{1/(1+\mathcal{D}_t)}\right)^2\frac{F_{it}}{2\mathcal{D}_t} \tag{19}$$